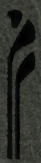
The

NCLAIR·HANDBOOK OF·PHOTOGRAPHY

PRACTICAL·GUIDE·TO·THE·PROCESSES OF·MODERN·PHOTOGRAPHY·BY LEADING·EXPERTS

EDITED·BY

JAMES·A·SINCLAIR F·R·P·S



PRICE ONE SHILLING AND SIXPENCE NET

Published by

JAMES·A·SINCLAIR·&·CO·LTD

PHOTOGRAPHIC·AND·SCIENTIFIC APPARATUS·MANUFACTURERS

54·HAYMARKET·LONDON·S·W

1913

THE SINCLAIR HANDBOOK OF PHOTOGRAPHY.

The SINCLAIR HANDBOOK of PHOTOGRAPHY

A PRACTICAL GUIDE TO THE PROCESSES OF MODERN PHOTOGRAPHY BY LEADING EXPERTS

EDITED BY
JAMES A. SINCLAIR, F.R.P.S.

SECOND EDITION

PRICE
ONE SHILLING AND SIXPENCE
NETT.

PUBLISHED BY
JAMES A. SINCLAIR & CO., Ltd.,
PHOTOGRAPHIC AND SCIENTIFIC APPARATUS MANUFACTURERS,
54, HAYMARKET, LONDON, S.W.

1913

PREFACE.

THE aim of this book is to answer as clearly as possible many of the enquiries that are addressed to us from day to day in the course of our business. The majority of people to whom the fascination of the photographic process appeals on one ground or another, do not want to examine too minutely its scientific side. The print, or maybe the lantern slide, is the object of their quest, and the number of grains of silver contained in the emulsion of plate or film is of little importance, provided there is enough to give a good negative on development. They are content to know the general principles underlying a process if it leads to better work, but are prepared to leave the details to the specialist. Consequently we have tried to embody just so much of the science as will help the reader to make the best possible negative on the first stage of his journey, and to attain the goal of perfect print, or transparency, or enlargement.

Contents.

EXCAVATIONS IN EGYPT.

Taken with the Sinclair "Una" Camera by the Earl of Carnarvon.

How to Take a Photograph.

CHAPTER I.

The Camera and the Lens.

Photography is one of the most delightful of recreations, and whether we are interested in it for its pictorial possibilities, its value as a recording medium, or for the scientific phenomena of which it is the expression, we shall find in its study a never-failing source of pleasure. Some workers think of the results only and care little for the processes by which they are effected; others concern themselves with the processes and the results are of secondary importance, but the real photographer, and the only one who gets his full meed of enjoyment, finds fascination in every step of the way taken to the goal of the finished print. Now, if we give the subject a moment's consideration, we shall recognise that the taking of a photograph is a marvellous phenomenon, and it is not any matter for wonderment that savage tribes should look upon a photographer as a black magician. Certainly the magician of the middle ages was one who knew a little more of the laws of nature than his fellows, and as a result of this knowledge he stood a good chance of ordeal by fire to prove that after all he was much as other men.

THE SIMPLEST CAMERA.

To take a photograph, it is necessary to have a camera or box into which light can only enter through an aperture at one end. This aperture may be simply a small hole, or a greater refinement is attained by passing the light through a lens. A camera or box with a hole at one end will make quite excellent photographs. Should we wish to try the experiment, it is well to get a box which will hold an ordinary photographic plate, say, the size known as $\frac{1}{4}$-plate, and which measures $4\frac{1}{4} \times 3\frac{1}{4}$ inches. In the centre

of one end of the box we bore a hole, and over this place a piece of thin brass, preferably blackened, in which a hole has been made with a fine needle, say a No. 10. (*a*) The edges of the brass plate should be glued to the box with black paper and the box should be lined with black paper so that it is thoroughly light-tight. Now, in the "dark-room," by the light of a ruby lamp, we fit a rapid photographic plate in the end of the box facing the hole in the brass plate, close the lid and see that it is absolutely light-tight, wrapping black paper round it, if necessary, and meanwhile covering the pinhole. If we set our box on a table or stand and uncover the pinhole on a sunlit street in say, May to July, from 9 a.m. to 3 p.m., and give an exposure of about 12 seconds, (*b*) we may expect to get a good picture on development, providing the sensitive plate is set about 5 inches from the pinhole. If the plate is further from the hole the time must be increased, as also it must for slow plates, or dull light, or other months of the year. It will readily be seen that such an arrangement as this simple camera is too slow for photographing moving subjects, and consequently for all practical work we use a lens. But before discarding our box and pinhole, it will be interesting to knock out the end of the box opposite the pinhole and to hold a piece of ground glass over the opening, covering the end of the box with a cloth, then, placing our head under the cloth and directing the pinhole towards a candle flame or other brilliant object, we shall see the image shown upside down on the ground glass. The reason for this is apparent. Light rays are given from all parts of the flame and they can only pass through the small hole, and so if we draw a line from the top of the flame through the pinhole it will go towards the bottom of the plate, and lines drawn from the bottom of the flame can only reach the upper part of the plate. As light travels in straight lines through any one medium, and in this case the medium is air, it will be seen that the image can only be formed in this way. If, however, we endeavour to make the hole larger, to get through more light, we shall find our image on the ground glass becomes hazy and undecided, for rays from several parts of the candle flame impinge on one spot and prevent a sharp image. To obviate this great disadvantage we interpose, between the object and its image on the ground glass, something which we call a lens, to bend the rays as we want them bent, so that all the rays emanating from any

(*a*) The Watkins Pinhole Lens is a cheap and desirable adjunct for those who wish to do this work with an ordinary camera.
(*b*) For Table of Exposures; see Appendix.

one point are brought to a focus at another point on the ground glass or sensitive plate. Now, while in this article we shall not go into details as to lens construction, it will be readily surmised that it is an expensive and difficult matter to make a lens of very large size or aperture, so constructed that rays striking any part of its surface shall be correctly bent and brought exactly into focus, or in other words, so that they meet at a point on a plane surface.

THE LENS.

Moreover, there is another peculiar phenomenon connected with our rays of white light. These rays are not simple rays, but are composed of various colours, and it is found that certain media which bend the rays of white light passing through them also resolve these rays of light into their component parts to a greater or less extent. So that not only have we to bend the rays of light as we require them to come to a focus on one plane surface, such as our sensitive plate, but we also have the difficult problem of keeping the rays intact so that the diverse elements forming the ray come into focus at that point.

THE SUPERIORITY OF MODERN LENSES.

The guiding of our ray of light is, therefore, a problem requiring not only the greatest mathematical precision in calculation, but the finest technical skill in lens manufacture. Some of the highest-class modern lenses consist of as many as eight lenses cemented in pairs of four each. Each surface has to be ground with the nicest accuracy so that it exactly fits the one in contact with it, made of glass of a different density, and when we think of the difficulties of manufacture we shall be surprised at the cheapness rather than the dearness of such a beautiful and precise piece of work. The standard of excellence has been constantly getting higher, and when to-day anyone talks of the superiority of old lenses, it is like the person who acclaims the "good old times," their goodness being a creature of the imagination. Buy the best lens you can afford, but the best is not necessarily the most expensive.

THE BEST LENS FOR GENERAL WORK.

If you only want one lens for all-round work get one of the rapid type—preferably an anastigmat of some good make—and working at anything from *f*/6 or *f*/8, and of a focus somewhere near the measurement of the diagonal of the plate on which it is to be used. When the pocket permits we suggest either the Zeiss Series VII. Double Protar or the Ross

Convertible Lens, in both of which the single elements forming the lenses are so perfectly corrected in themselves that they may be used for nearly every kind of work, and consequently we have two or three lenses of varying foci in one. Lenses of this nature are suitable for everything the photographer may want to do except very wide-angle work and very high-speed work. Other fine anastigmats are made by Busch, Dallmeyer, Goerz and Voigtländer, nor must we omit to mention the "Cooke," an excellent lens and not quite so expensive as some of the others.

THE BEST LENS FOR HIGH-SPEED WORK.

For work of great rapidity a lens with a larger aperture is essential, and in the first rank we would place the *f*/4·5 Zeiss Tessar and *f*/4·5 Ross Homocentric, both very desirable lenses for focal-plane cameras, and also for portrait work. The only objection to these lenses is the price, and to most photographers lenses of *f*/6 or *f*/8 aperture will suffice for every need.

ON LENSES FOR WIDE-ANGLE WORK.

For the architectural photographer one other form of lens is undoubtedly required, particularly for work in confined situations, and such a lens is called a wide-angle lens, because it will cover a larger plate than is the case with the usual rapid types. As a general rule, wide-angle lenses are very small and the elements are so close together that light can pass through them at a very oblique angle. There is a good deal of misconception regarding wide-angle lenses by beginners. They imagine that a wide-angle lens is always a wide-angle lens, irrespective of the plate on which it is used, but such is not the case, it depends entirely on the relation of its focus to the size of plate used. For instance, a 5-inch wide-angle lens used on a $4\frac{1}{4} \times 3\frac{1}{4}$ plate would not give any wider angle than any other lens of 5-inch focus used on the same plate, for the angle of view would be the same in both cases. But if we put our 5-inch wide-angle lens on an $8\frac{1}{2} \times 6\frac{1}{2}$ plate we do get a wide angle, for the view which was illuminating the inside of the camera bellows when the lens was on a $\frac{1}{4}$-plate camera is now covering effectively our larger plate. If we tried to put our ordinary 5-inch lens on an $8\frac{1}{2} \times 6\frac{1}{2}$ plate we should probably find it was covering perhaps a 7-inch or 8-inch circle and that the corners of the plate were not illuminated, and consequently such a lens would be worthless as a wide-angle lens on a

plate of that size. As a general rule, a lens which will cover effectively a plate, the shorter side of which is equal in length to the focus of the lens, may be termed a wide-angle lens. Editors who conduct photographic columns of papers are frequently asked whether a lens will be strained by putting it on a certain size camera. Now a lens is not like a muscle—no damage will accrue to the lens from its being placed on any size camera, for it will only work to the limit of its powers.

PORTRAIT LENSES.

Amateurs are often prone to imagine that there is some marvellous property inherent in portrait lenses, and they frequently purchase and take home with glee a prize found in some pawnshop. The older worker is not to be caught with pawnshop bait. The fact of the matter is, that the general improvements in the anastigmats and the increased rapidity of plates has made the old portrait lenses a drug on the market, and amateurs should be shy of buying such lenses without careful consideration as to whether they would suit their purpose. Any lens may be used as a portrait lens, but it is desirable that as long a focus as possible should be used ; for the further the camera is away from the sitter, the more natural and pleasing will be the ultimate result. Of course, for studio work a large aperture portrait lens by a good maker is often a desirable acquisition, but it must not be forgotten that such a lens requires a studio camera, or at any rate a long-focus camera of the square type. During recent years a number of makers, principally in France and America, have devoted themselves to constructing lenses for portraiture which will give broad and painter-like effects, owing to the fact that microscopic sharpness is impossible with them. The results are certainly pleasing and greatly reduce the retouching necessary on the negative. The Spencer Soft-Focus Lens is a typical and excellent example of this class.

THE BEST LENSES FOR TELEPHOTOGRAPHIC WORK.

Telephoto lens combinations have been considerably improved during the past few years, and more is known of the principles underlying their successful use. Such lenses, exceedingly valuable as they are, should not be purchased till the worker can make good technical negatives when doing ordinary work. If a telephoto attachment is then required it may be had as a separate fitting, which is placed between the positive lens and the camera, and such an attach-

ment will usually give a great range of magnification. The shorter the focus of the negative lens, the greater the magnification with any degree of camera extension, but the smaller the plate covered. This being the case, the worker to whom cost is of little moment will probably have three tele-negative lenses, all to fit into the same tele-tube, and they should be as follows :—

For high-power work, the focus of tele-negative should be $\frac{1}{4}$ that of positive lens.*

For medium and general work, the focus of tele-negative should be $\frac{1}{3}$ that of positive lens.

For low-power and rapid work, the focus of tele-negative should be $\frac{1}{2}$ that of positive lens.

While all these lenses would, perhaps, permit of the same mangification being secured, it is probable that the high power and shorter-focus negative lens would not cover the plate to the margins under about four magnifications, while the low power in which the focus of the tele-negative is half that of the positive lens, would probably cover the plate to the corners with two magnifications. On the other hand, the low power would require greater camera extension, and consequently we recommend for general work a tele-negative of one-third the focus of the positive lens.

LONG-FOCUS LENSES WITH SHORT CAMERA EXTENSION.

During recent years opticians have devoted much attention to a modification of the Telephoto lens, so that it is now possible to use a lens of long focus, but requiring short camera extension. Of course, such lenses are not variable in focus, but they have the advantage of rapidity and are undoubtedly easier to use than the regular telephoto system. The "Magnar" of Zeiss is of 18-inch focus, works at *f*/10 and requires a camera extension of 6 inches. The Bis-Telar of Busch, is made in a great variety of foci, and nominally works at *f*/7, but we ourselves when using this lens always stop it down to *f*/11 because we wish our results to stand enlargement. Dallmeyer makes an "Adon" of 12-inch focus requiring a camera extension of $5\frac{1}{2}$ inches and working at *f*/4·5. The best of this type is the Ross "Telecentric," the definition of which at *f*/5·4 is remarkable. It is made in a number of sizes, the foci varying from 9 in. to 17 in., and in each case the camera extension is only about half the actual focus.

* For Telephoto Calculations, see Appendix.

It must be borne in mind that none of the lenses of this type are rectilinear and care must be taken not to use them on subjects where vertical or horizontal lines come near the edge of the plate.

In telephotographic work the greatest aid to good work and brilliant negatives is a satisfactory adjustable lens hood. This cuts out much of the light excepting that used for forming the image, and the difference in result between negatives taken with and without the hood is hardly credible, except to those who have made the experiment.

THE LENS APERTURE, FOCUS AND THE DIAPHRAGM OR STOPS.

If we look at a dealer's catalogue we shall at first feel bewildered by the multitude of lenses all seemingly doing, or capable of, the same work, and only varying from each other by *f* values, or foci, or cost. The first thing that we notice is that lenses are marked with *f* values, and we must know the meaning of such terms as *f*/4, *f*/8, *f*/16, etc These numbers simply show the relation between the diameter of the cone of light passing through the lens and its focus. Very roughly with all doublet lenses we may take the distance from the diaphragm stop to the plate when distant objects are in focus and call it the focus of the lens. Then again, approximately the diameter of *f*/4 stop would be one-fourth of that distance, *f*/16 one-sixteenth of that distance, and so on in proportion.

In the case of a lens of 8-inch focus *f*/4 would pass a cone of rays 2 inches in diameter, *f*/8 one inch in diameter and *f*/16 a half-inch in diameter.* When, therefore, we see a lens marked in a catalogue as *f*/4 it means that the largest aperture of that lens is one-fourth the focus of the lens. As previously stated, this is approximately correct, and we have known some workers to have been seriously troubled at what they have imagined to be the wrong markings of the apertures, for as a matter of fact a diaphragm under some circumstances will pass a larger bundle of light rays than its own diameter. For those who want to accurately test the foci of their lenses and examine the effective apertures of the stops, particulars will be found in the appendix.

In purchasing a lens the work for which it is required must be borne in mind, and for general use lenses working at, say, *f*/6·3, are desirable ; for rapid work on moving objects such as express trains, diving, etc., we shall require an aperture of *f*/4·5 ; but for long

* For an explanation of the numbers on Kodaks, see Appendix.

distance landscape work an aperture of $f/12{\cdot}5$ is amply sufficient. *As a guide to the beginner we might mention useful foci for a complete outfit.*

For plates	$4\frac{1}{4} \times 3\frac{1}{4}$ in.	5×4	$6\frac{1}{2} \times 4\frac{3}{4}$	$8\frac{1}{2} \times 6\frac{1}{2}$
Lens for general use	5 in. to 6 in.	6 in. to 7 in.	8 in. to 9 in.	10 in. to 12 in.
Lens for wide-angle work	3 in. to 4 in.	4 in. to 5 in.	5 in. to 6 in.	6 in. to 7 in.
Lens for long-focus work	9 in.	$11\frac{1}{2}$ in.	14 in.	16 in. to 19 in.

DEPTH OF FOCUS OR DEPTH OF FIELD.

The smaller the aperture of the lens in proportion to its focal length the greater is the depth of field, *i.e.*, the greater is the range between near and distant objects in focus at the same time, and the importance of this is often overlooked by those who purchase expensive lenses with large apertures, particularly for hand-camera work. With such lenses objects have to be most carefully focussed and there is little range for error, whereas lenses with small apertures permit of considerable latitude in focussing. A table is given in the appendix which shows how greatly the depth of field is extended, by stopping the lens down.

THE CAMERA.

At the commencement of this article we described the simplest form of camera, yet such a black box is severely limited in its scope. Unfortunately the tendency to-day is to try and cram into cameras all sorts of unnecessary movements which weaken the construction and are only required by one in a hundred, and then only for some special work.

Generally speaking, for all-round work a camera should have the following attributes :—

It should be well made and with a bellows as nearly square in front as possible.

It should have rackwork extension sufficient for lenses of foci given above.

It should have reversing back, revolving or otherwise.

It should have considerable rising front.

It should have a securely clamped front, absolutely parallel to the surface of the plate, and one which does not sag or get out of parallel when extended.

A useful movement, but one not usually required when cameras have a great rise to the front, is either a swing back or, perhaps better still, a front which swings on the axis of the lens.

Some cameras fill the above requirements and are equally useful as hand or stand cameras, but for purely hand-camera work the reader would do well to read the article on Hand Cameras and their selection.

THE TRIPOD STAND.

If the photographer wishes to do interior work, architecture, or telephotography, a good rigid stand is essential. The light metal stands, although exceedingly portable, may be useful for a certain amount of work with small hand cameras, but if hard wear and tear is probable then we should strongly recommend a tripod made of wood. In the case of telephotography an additional leg should be had for the front of the camera or to support the telephoto lens.

Having the instrument for taking the pictures the next point for consideration is the medium on which to take them, and in the next chapter we shall consider the sensitive plate and film.

E. G. Becher, Esq.

THE FALLS OF THE ZAMBESI.

Reproduced from negative taken with the Sinclair " Una " Camera.

CHAPTER II.

The Photographic Plate or Film.

The sensitive plate or film is a very wonderful thing. The essential part of it consists of a thin film of gelatine containing certain salts of silver. When light strikes this compound of gelatine and silver it upsets it in such a peculiar way that, although not altered in appearance, when placed in various chemical solutions the silver salts are reduced to a metallic state. It is this fine deposit of metallic silver which forms the negative image. When we know that light striking the plate for an infinitesimal period of time is able to affect it in this way we can realize the immense importance of care in loading our dark slides or changing boxes by means of a safe light. Generally speaking, all ordinary plates, even the most rapid ones, are but slightly sensitive to the red rays contained in white light and therefore a red light is used in the dark-room for examining and developing the plates. For special purposes, however, plates are made sensitive to red light and are then known as "panchromatic." Such plates require the very greatest care and should be developed in the dark or by means of a special green light which only passes that portion of the spectrum to which they are most insensitive. Other plates are called Isochromatic, Chromatic or Orthochromatic, and these, while being more sensitive to yellow light than the ordinary brands, can safely be developed by a good ruby light.

ORDINARY *v.* ORTHOCHROMATIC PLATES.

During recent years there has been a decided tendency to use colour-sensitive plates and it may seem late in the day to advocate the ordinary plates for general photographic work. While we are quite prepared to admit the claims of the advocates of colour-sensitive plates for special purposes, such as copying pictures and cloud photography, we are disposed to think that in endeavouring to truthfully portray colour values they lose

the greater and more important truth of colour contrast. In landscape work, particularly when a screen is used, there is a pettiness and spottiness in the resulting picture ; quite apart from its false sky which may in tone represent the dark blue of the vault of heaven,

BOCKLETON CHURCH.

Snapshot, taken with the Sinclair "Una."

but entirely opposes the fact that it is the source of light. Such orthochromatic and panchromatic photographs, although possibly admirably and exactly portraying the details of natural phenomena, yet entirely fail to stir the feelings, because they do not record the impressions of air and space.

FAST OR SLOW PLATES.

For general work, including architecture and portraiture, we advocate the fastest possible plates. An extended period of photographic work, during which many thousands of plates or films have passed through our hands, shows conclusively that the great majority of results are spoilt by under-exposure. For our part we look forward to the time when the speed of plates will be greatly augmented. When a snap-shot picture can be taken by lamp light with an *f*/6 or *f*/8 lens we shall begin to be satisfied, but not before that desirable era.

A fast plate, excepting for copying line subjects, has no drawback that we have been able to discover, although writers in text books, perhaps stimulated by the remarks of plate-makers, have consistently advocated plates of low speed. A fast plate has a longer range of gradation, and, generally speaking, gives more harmonious prints and enlargements, and providing care is taken to have proper dark-room illumination we should strongly recommend their use.

For copying line subjects a "process plate" which tends to give hard results is desirable and, of course, orthochromatic or panchromatic plates with proper screens must be used for copying pictures or other works of art.

For telephotography it is often necessary to cut out blue haze and then panchromatic plates with a proper screen will give the result demanded.

PLATES OR FILMS.

All the remarks we have made concerning plates apply equally to films, but in the claims between these two vehicles for carrying the sensitive emulsion we recommend plates where their use is at all possible. We are not unmindful of the value of films for many purposes, and their general quality is now very high, yet for the very best results plates should be used. There seems to be some antipathy between the celluloid film and the gelatine emulsion, which conduces to the deterioration of the latter in a most unaccountable manner. An emulsion always seems slower when on a celluloid support; and, generally speaking, for scientific work, either in hot or very cold climates we have had occasion to say that "weight for weight plates will give better results." Still the

FILMS FOR THE TROPICS.

weight of plates is frequently an effectual bar to their use. When such is the case, and when films must be used, it is essential when taking them to hot or moist climates to properly pack them in tin cases with some damp-absorbing material. Moreover, they should be kept as little a time in the camera as is possible and in no case should they remain in the camera over night.

PLATES FOR TRANSPARENCIES WHEN ENLARGING.

For lantern slides and transparencies special plates are made by all makers, but if it is desired to make a transparency from which to make an enlarged negative, then such lantern plates should not be used unless the original negative is a particularly thin one. For such transparencies from good negatives we recommend an " ordinary " plate of any good brand, and it should preferably be backed. The transparency to aim for, is one thin and full of detail, and absolutely free from fog. When laid film downwards on a sheet of white paper it will show all the details of the picture excepting in the very highest lights. From such a positive a negative of any character may be made on a good ordinary plate.

BACKED OR UNBACKED PLATES.

The best results are most easily secured by what are termed " backed " plates. Backed plates have the glass side covered with some pigment and the object is to absorb light which passes through the sensitive film and which otherwise being reflected back again from the glass surface impairs the perfection of the result, by forming a halo round any strong high-light. Backed plates are always desirable even for making lantern slides, and we never take a negative on any other.

CHAPTER III.

Exposing the Plate.

On the exposure the whole of our *after* success depends, and consequently too much consideration cannot be given to this portion of our subject. Fortunately for the photographer the photographic emulsion has a very considerable measure of latitude and allows to some extent for defective judgment, so that the problem is not so insuperable as might at first sight appear. Indeed, with exposure meters and exposure tables the photographer has many excellent guides which will keep him within the limits of permissible error.

The time of exposure depends on a great number of conditions, the most important of which are :—

The rapidity of the plate.
The aperture of the lens.
The latitude.
The meteorological conditions.
The time of the year.
The nature of the subject.
The altitude.

The earth being surrounded with an envelope of atmosphere which absorbs those rays which specially affect our photographic plate it will be seen that the nearer the sun is to the horizon the more this envelope intercepts the actinic rays, and consequently exposure is prolonged. This accounts for the difference in exposure needed in summer and winter, or between morning or evening and noon. In the same way in high altitudes there is less air intervening between us and the sun and photographic exposures in such altitudes are greatly reduced.

Moisture and dust also act as light filters and both modify our photographic exposures. To show how the chemical activity of the light varies in different places at the same time Mr. Chapman Jones in " The Science and Practice of Photography," gives the following table showing its proportional value in Iceland, Manchester and Cairo on the 25th March for each hour during the day.

A.M.	P.M.	Iceland.	Manchester.	Cairo.
6	6	0	0	0
7	5	·02	·22	1·74
8	4	1·53	5·85	20·13
9	3	6·62	18·71	50·01
10	2	13·27	32·91	78·61
11	1	18·60	43·34	98·33
Noon.		20·60	47·15	105·30

In order to gauge the actinic value of the light such exposure meters as Watkins' or Wynne's are exceedingly useful. Both consist of slide rules in the form of a watch and contain a special sensitive

OUTSPANNED FOR THE HEAT OF THE DAY. *By Major S. Evans.*
Taken with the Sinclair "Una."

paper which darkens on exposure to light. By setting the stop used on the scale against a number supplied by the meter maker to represent the make of plate used, then noting the time for the paper to darken, the exposure for all ordinary subjects may be read off against this time where engraved on the meter. This is the Watkins' method and the Wynne is practically the same in practice. For special subjects the user may multiply or divide the meter results according to a table supplied. Even if the photographer purchases one of these excellent actinometers we should recommend the further acquisition of Wellcome's Photographic Exposure Record and Diary. This is published each year and is crammed full of most useful information. It is arranged with tables for different latitudes, and there are editions for both Northern and Southern hemispheres.

The following table will, however, be useful for reference and might with advantage be copied out and pasted in the lid of camera case.

Approximate exposures with ultra rapid plates on all ordinary subjects, such as street scenes, in towns, etc., in fractions of a second. 52° North latitude. Aperture of Lens, *f*/8.

	Brilliant sunshine.	Sun through light clouds.	Diffused light.	Dull.	Very dull.
a.m. p.m.					
November, December or					
January .....11 to 1	1/25	1/16	1/12	1/8	1/6
,, ,, ..10 or 2	1/16	1/12	1/8	1/6	1/4
February and October ..11 to 1	1/35	1/25	1/14	1/12	1/8
,, ,, ..10 or 2	1/25	1/16	1/12	1/8	1/6
,, ,, .. 9 or 3	1/16	1/12	1/8	1/6	1/4
March and September ..10 to 2	1/50	1/35	1/25	1/16	1/12
,, ,, .. 9 or 3	1/35	1/25	1/14	1/12	1/8
,, ,, .. 8 or 4	1/25	1/16	1/12	1/8	1/6
April and August .... 9 to 3	1/50	1/35	1/25	1/16	1/12
,, ,, .. 8 or 4	1/35	1/25	1/14	1/12	1/8
,, ,, .. 7 or 5	1/25	1/16	1/12	1/8	1/6
May, June and July .. 9 to 3	1/75	1/50	1/35	1/25	1/16
,, ,, .. 8 or 4	1/50	1/35	1/25	1/16	1/12
,, ,, .. 7 or 5	1/35	1/25	1/14	1/12	1/8
,, ,, .. 6 or 6	1/25	1/16	1/12	1/8	1/6

Most special rapid plates would require double these exposures and ordinary brands three or four times these exposures.

The exposures must also be multiplied or divided for all such special subjects as follows :—

Open scenes in villages, such as village greens and where there are no very near objects, cricket matches, etc. .. $\frac{1}{2}$ the indicated exposure.

Distant landscape, beach, river and shore scenes ..... $\frac{1}{4}$,, ,,

Open seascapes..... $\frac{1}{8}$,, ,,

Clouds ..... $\frac{1}{16}$,, ,,

Subjects with heavy foregrounds, architecture, etc. ..... double ,, ,,

Portraits and very dark near subjects 4 times the indicated exposure.
Tree-covered lanes, etc. .....8 to 16 „ „
Indoor portraits ..... 32 times „ „

The exposures given are for use with *f*/8 stop. Other apertures on the lens would require as follows :—

f/4·5 *f*/5·6 *f*/11 *f*/16 *f*/22 *f*/32
1/3 1/2 2 4 8 16 times the indicated exposure.

Consequently it will be seen that the great value of a lens with large aperture is for photography when the light is bad. With a *f*/4·5 lens for example, snap-shots might be made of street scenes in December in about 1/48th second—an important matter to the press photographer.

In Southern Latitudes the table would, of course, be reversed, *i.e.*, June exposures would be altered to December and December exposures to June, and so on with the other months.

THE EFFECT OF ALTITUDE.

Alpine climbers quite recognise the importance of this factor. As we ascend the actinic value of the light increases and at 5000 feet exposures may be halved, and at 7500 only one-third of the exposures indicated should be given. The increase in ultra-violet rays also makes itself manifest by causing sunburn.

Such hints as these will help the beginner, and although exposures given are approximate only, we think they will be found of use in showing the principles governing this important subject.

CHAPTER IV.

The Dark-Room and its Equipment.

For developing our plates a " dark-room " is essential, and when we say a " dark-room " we mean a real " black room," as they have it in French, and not a room in which things are barely visible after having been in it for some minutes. The dark-room should be one in which not a trace of white light can enter. Of course, many amateurs have to content themselves with coal or wine cellars, or even bedrooms at night, but in any case care should be taken to shut out every trace of light that might fog our plates.

THE ILLUMINATION OF THE DARK-ROOM.

If a room has to be made into a temporary dark-room by means of blinds or screens, it is very desirable that these blinds or screens should be opaque, and that artificial light only be used for development. Perhaps the best way to do this is to have two blinds, one a red one which will make the room safe for bromide work and another a black or green blind which, coming down over the red one, entirely cuts out any trace of light and makes the room absolutely dark.*

The " De Luxe " method of lighting, where a room is at the disposal of the photographer and where he has electricity, is to have all the light used for illumination reflected from the ceiling. This is effected by having tubular electric lamps arranged in a moulding like a picture rail, and these lamps are covered with orange glass. Most workers, however, require a lamp, and the largest possible is the best, providing it is safely screened. If an electric lamp is used the lantern body should have grooves at the front which will take any combination of glass or fabric, and should also have screens at the sides to light up the bench or shelves. A similar lamp may be used for paraffin, and in this case the oil reservoir should be large and fitted with a good burner. Most of the commercial lamps are eminently unsatisfactory, due to the constant cutting of prices.

* The Sinclair Dark-Room Blind is made on these lines.

If from considerations of pocket a cheap lamp must be purchased, it is advisable to throw away the piece of ruby glass and substitute for it a screen made of two thicknesses of ruby fabric, either between two glasses or with the edges bound with tin. The Ilford lamp screens are also strongly recommended ; and a Wratten screen is essential for Panchromatic plates.

In fitting up a dark-room have a good large sink, lead-lined, with shelves on both sides and a narrow shelf at back, all of which should, if possible, be lead-covered. The water supply may be in the form of a swing tap with reversible end, or simply a tap to which a Berkefeld filter or a simple " anti-splash " is attached. Warm water is a great convenience, and if it cannot be obtained in the dark-room an instantaneous water heater of extremely small size may be hung on the wall at the back of the sink and attached to the water supply. This will give a supply of hot water at the rate of a quart a minute, but it can only be used where there is a gas supply. Below the sink and its adjacent shelves should be arranged a drawer for developing clips, brushes and other sundries, and below this again a shelf to hold hypo tank and also racks for developing dishes.

Wires may be stretched across the room and above the developing sink, and these are useful for suspending prints by means of clips for drying purposes.

DEVELOPING DISHES.

Developing dishes should be of porcelain, or preferably, of granitine, a sort of white porcelain which will stand quite considerable heat. It is easy to see that such dishes are clean.

In looking through a catalogue many things will be found desirable for dark-room equipment, and the matter of racks, washers, measures, etc., may be left to the individual requirements of the photographer.

CHAPTER V.

Developing the Plate or Film.

"First catch your hare, then cook him," says the old proverb, and providing a plate has been exposed in accordance with the foregoing instructions, and our dark-room being at command, we may finish the first stage of our work and make the perfect negative.

As previously pointed out the action of light on the sensitive surface is an invisible one, the salts of silver, with which the plate is coated, being to all appearance just the same as when the plate was inserted in camera, or dark slide, or changing box. As the exposure has not in any way decreased the sensitiveness of the plate, great care must be taken till development is concluded that no white light reaches the plate or film, and when we say no white light we mean no light excepting that from a safe dark-room lamp. We have known beginners at photography explain that they have used every care, and on enquiry find they did just glance at the plates late at night in a room which had no direct light, but opened on to a passage or courtyard.

Supposing we have only a few plates to develop we shall prefer to use a dish, and there is always pleasure in seeing the gradual growth of the image when developing in a dish that is absent when using a tank.

As for the developer, it is often said that any developer will suffice for a properly exposed plate, but we have a strong preference for a Pyro developer, for, as a rule, it gives prints of better quality. Old "Pyro" users know what we mean, and although admitting the cleanliness and very beautiful-looking negatives obtained with other developers we maintain that there is a quality in prints from pyro negatives—particularly in platinotype—which is lacking when some other reducing agents are used.

The formula we favour is as follows :—

No. 1 *Solution.* Take 1 oz. Pyrogallic acid,
$\frac{1}{2}$ oz. Metabisulphite of potash,

place in a 10 oz. bottle, fill with water and label Pyro 10%.

No. 2 Solution. Take 4 oz. Carbonate of soda,
4 oz. Sulphite of soda,
place in a 20 oz. bottle, fill with water and label Soda 20%.

Then to each 1½ ounces of water add 40 minims of the No. 1 Pyro Solution and ½ ounce of the No. 2 Soda Solution. If the plates tend to give soft results the Pyro Solution may be increased to 60 minims (1 dram). Use the developer at a temperature of 65°F, or "just off the chill."

Place the negative in a clean dish and don't remove the "backing," if a backed plate; use plenty of solution, which flow quickly all over the surface, taking care not to get air-bells; note the time by your watch and cover the dish with a piece of cardboard or any other screen. Keep the dish slightly moving, and if properly exposed the image will commence to appear in about thirty seconds. With most brands of plates this developer will develop a good brilliant negative, suitable for platinum printing in five minutes, although other makes, such as Ilford Monarch, require about eight to ten minutes. In any case don't remove the plate from the developer till it has been sufficiently developed, and it is better to carry the action a little too far than not far enough. The image will apparently be lost on the surface of the plate, and it will seem to blacken all over—except the edges which were covered in the dark slide—and be entirely ruined. If the plate was "backed" the backing should now be removed, which is done by brushing it off with a stiff dish brush in a dish of clean water. The image may, at least in the sky portions, be now visible on the back of the plate. Give a rinse in a dish of water and immerse in a Fixing Bath, made as follows:

Hyposulphite of soda	5 ounces.
Water to	20 ounces.
Metabisulphite of potash or Metabisulphite of soda	1 ounce.

The hypo and water will do quite well by themselves, but the metabisulphite of soda not only keeps the bath clean and tends to remove stain from the negative, but it also hardens the film and helps to prevent frilling. When hypo and water are used alone the plate must be kept in the dark-room till fixed, unless it has been thoroughly washed before immersion in the bath. The metabisulphite makes the bath acid and this destroys the active power of the developer in the film, so the same care about light is not necessary.

The use of the fixing bath is to entirely remove all the creamy-looking silver compound contained in the plate and which was in excess of the quantity used to form the negative image. Even when this is all removed and the plate seems clear, it should be kept for a few more minutes in the hypo bath, as there are some salts which, although invisible, are detrimental to the plate and must be removed by the fixing bath.

The plate at this stage should look like a clean, good negative, and when viewed by transmitted light the dark parts should not appear absolutely opaque. If laid down on a sheet of white paper there should be no quite transparent portions, unless we except the edges of the plate which were not exposed to light.

The plate must now be washed for twenty minutes in running water, or if that is impossible, in five or six changes of water. Then wipe over the gelatine surface with a piece of cotton wool or the ball of the finger to remove any sediment from the water, give a final rinse, and dry in a good current of air. Drying may be accelerated by blotting the surface of the plate with a clean handkerchief, so that all superfluous water is removed.

TANK DEVELOPMENT.

Tank and time development has greatly grown in favour during the last few years, and, generally speaking, a higher average of negative is obtained by using a constant developer at a constant temperature for a specified time than by any tinkering in the dark-room. The system is based upon the time necessary to get a good negative from a properly exposed plate or film, and works admirably in practice. An under-exposed plate or film is of no use at any time and if much under-exposed the best plan is to let it go into the dust-bin. In cases of over-exposure it is necessary to develop just as long as we should a correct exposure. If we stop development at an earlier stage we shall only get a thin, flat, foggy-looking negative which would not give a decent print in any process.

The expert who has cases of known over-exposure or under-exposure to deal with, can, perhaps, modify them to some extent, by in the first instance, using a strong and highly restrained developer, and in the second case by using a weak developer, or at least weak in the essential elements of pyro or other silver reducing salt. This is the reverse practice of the inexperienced, who fancy

that over-exposure requires a weak developer and so use a compound that tends to accentuate the flatness of the result.

For tank development the following Kodak formula is very satisfactory :—

Pyrogallic Acid Stock Solution.

Pyrogallic acid	1 ounce.
Sulphuric acid	20 minims.
Water	28 ounces.

Soda Stock Solution.

Sulphite of soda (cryst.)	6 ounces.
Carbonate of soda (cryst.)	4 ounces.
Water	to 28 ounces.

For development take 1½ ounces of each of these solutions and make up to 20 ounces with water. Time of development is 10 minutes at temperature of 65°F.

Watkins' Thermometer Solution.

20 minims Sinclair No. 1 Pyro Solution.

100 minims Sinclair No. 2 Pyro Solution.

made up to 1 ounce with water and 5 minims 10% Brom. Pot. added.

This is same composition as Watkins' Thermo Soda.

DEFECTS AND THEIR CAUSES.

Foggy and Thin-looking Negatives. We are constantly shown negatives thin and flat-looking with general fog all over, and complaints are made that the plates must be defective. Generally speaking, defect is due to under-exposure. In such cases, particularly with rapid plates, the developer must do some work, and it consequently reduces silver all over the plate, causing the general fog. A rapid plate that has not been exposed to light will darken when placed in an active developer. We, of course, assume the dark-room light is reliable.

Hard and Brilliant Negatives. Although so different in characteristics from the sort of negatives described above, the cause is generally the same—under-exposure—but in this case the plate has probably been a slow one. To minimise the "soot and whitewash" trouble with plates prone to give it, reduce the "pyro" or the silver-reducing salt in the developer. Generally speaking, with proprietary developers, use less of the No. 1 or "A" solution, as this invariably contains the active agent, the "No. 2" or "B" being the accelerator.

Black Specks or Comet Light Markings in Negatives. These are usually caused by metallic particles in the water and are noticed when the plate is taken from the washing tank. They can be quickly removed by inserting the still wet plate in a solution of alum and hydrochloric acid.

Alum	1 oz.
Water	20 ozs.
Hydrochloric acid	½ oz.

When the spots are entirely removed wash again for five minutes, wipe the surface with cotton wool, give a final rinse under the tap and set to dry.

To Remove Yellow Stain from Pyro-stained Negatives. In the case of negatives being developed with insufficient sulphite in the developer or with an old pyro developer, they get very badly stained. The most effective stain remover is Leucogene, a chemical compound prepared by Messrs. Lumière.

THE CANADIAN ARCH FOR THE CORONATION OF KING EDWARD VII. *Jas. A. Sinclair.*

BRUGES.

Hand Camera picture taken with the Sinclair "Una."

CHAPTER VI.

Hand Cameras.—Their Selection and Use.

JAMES A. SINCLAIR, F.R.P.S.
By Furley Lewis, F.R P.S.

By JAMES A. SINCLAIR, F.R.P.S.

The selection of a Hand Camera requires as much care as the selection of a wife, and yet many people drift into this branch of photographic work with as little conscious thought as others drift into marriage. The position of the beginner is, however, a very difficult one. He knows nothing of the subject and is bombarded with advice by those who know but little more than himself. For light he consults a number of catalogues which only serve to intensify his confusion ; for each maker affirms that his specialities are the only ones a self-respecting photographer should use, backing the assertion with a pleasing reproduction of an express train, a man diving or some equally astonishing result that no one would desire to take a second time. The only way to buy the right article is for the would-be hand-camera worker to first analyse his own mind—to definitely decide on the extent of his aspirations, and then, with the various instruments outlined before him, to see in how far they will be likely to fill his wants.

The following classes will be likely to embrace most hand-camera workers, although, of course, there is no real line of demarcation between them.

1. THE BEGINNER who knows nothing of photography, but has a desire to obtain reminiscences of his home, or friends, or holiday scenes. He usually requires the simplest apparatus, and is often prepared to let someone else do the developing and printing.

2. THE TRIPOD CAMERA WORKER, who perhaps has a mild contempt for hand cameras and hand-camera workers. He may sometimes concede that a hand camera has limited uses and such a concession may be held as a sign of grace on his part.

3. THE HAND CAMERA ENTHUSIAST, who has perhaps at one time worked with a tripod, but realizes that the finest things are more easily secured with hand cameras, because of the spontaneity of scenes depicted. He will recognise the value of high-class apparatus.

4. THE PROFESSIONAL who wants a camera to take rapidly-moving objects under the most difficult conditions.

5. THE SCIENTIFIC EXPLORER who wants the best result for Geographical, Topographical or Ethnological reference. He does not mind a little extra weight or bulk, providing he obtains reliable records.

THE SELECTION OF A CAMERA.

Having divided the possible purchasers of cameras into several divisions, we will now consider the different types of instrument and see how far they are likely to meet the requirements of these various classes.

TYPE 1. THE KODAK TYPE, such as the various productions of the Kodak Company ; the Sinclair "Traveller" Roll Film Camera ; Ensigns ; Carbines, etc.

TYPE 2. THE AUTOMATIC CHANGERS. These cameras usually hold 12 plates in sheaths, which are changed by moving a lever or button on top or side of the instrument. They comprise the cheaper forms of hand cameras for use with plates.

TYPE 3. BOX-FORM CAMERAS. This is perhaps the oldest type of Hand Camera, and consists of a solid box with lens and shutter enclosed at one end and usually a changing box or dark slide at the other. Typical of this class is the "N & G" Special B.

TYPE 4. REFLEX CAMERAS, in which there is a full-sized focussing finder, as in the N.S. Patent Reflex ; "Soho" Reflex ; Adams' "Minex ;" etc. These cameras have superseded the Twin-Lens cameras, probably because with the Reflex Type the exact view

given on the plate is shown in the finder. With Twin-Lens cameras there is a considerable difference when focussing on near objects.

TYPE 5. FOCAL PLANE FOLDING CAMERAS, such as the "Zeiss Palmos," "Goerz Anschutz," and "Panros" Cameras.

TYPE 6. POCKET CAMERAS AND OTHER COMPACT FORMS, of which the smallest and amongst the best are the "Baby Sybil," "Goerz Vest Pocket Tenax," "Zeiss Bébé," "Block Note," "Vesta," etc.

TYPE 7. UNIVERSAL CAMERAS FOR HAND AND STAND on the lines of the "Sinclair Una," "Dallmeyer's Correspondence," and the "Sanderson." This is perhaps the most popular type amongst serious workers.

It must not be thought that the above is in any way a complete list. It only mentions the better known of the typical forms, but there are many others which the reader may place into his own category.

Let us now examine the types more closely and see the advantages and disadvantages of each.

TYPE 1. THE KODAK CLASS. Although I never use a Kodak, yet I am often compelled to recommend a camera of this type. To the tourist and traveller to whom bulk is of paramount importance, who won't consider any camera that involves changing in the dark, who simply wants a record of foreign travel and who is content with "pressing the button, while someone else does the rest," the Folding Pocket Kodak type can hardly be beaten. These cameras are simple and convenient, but I cannot recommend them to the photographer whose only aim is exact and perfect work. Much excellent work can be done with them and the inexperienced photographer will often get better results with a simple camera of this form than he would with a more perfect instrument, which of necessity is not quite so simple in design. The enthusiast may perhaps start with a Kodak—or even use it as an adjunct to his ordinary work—but as a general rule he will wish for an instrument with a greater range of movement, a better view finder than can be obtained in the limited space, and the peculiar uncertainty and unreliability of films. In cases where the price is not so material as perfection of result, although the advantages of lightness and simplicity are essential, I should advise either a Kodak with Zeiss or Goerz lens or a Sinclair "Traveller" Roll Film Camera, which, in addition to a Goerz lens, is made as a fixed focus camera with time and instantaneous shutter

"everset." Being of the box form it is always ready for use and is admirably adapted for all-round work.

Type 2. The Automatic Changers. Cameras of this type have not maintained the popularity they formerly enjoyed and are now generally made in the cheaper forms, ranging in price from 10s. to £3 3 0. Nearly all the makes on the market are reliable, so far as the plate-changing mechanism is concerned, and their value for photographic work may be usually gauged by the price. They will do quite good work in sunlight and are admirably adapted for presents to young people, in whom it is desired to inculcate a real love of photography by allowing them to develop their own plates and do their own printing. As a general rule, the lenses are not of a very high class and very frequently are too slow for the speed of the shutter, unless in brilliant sunlight; there is a tendency to dust from the plate-changing mechanism, and they usually lack the very desirable movement known as a "rising front." Of course, when these instruments are properly made and fitted with a really good lens and shutter, the very best work can be done with them.

Type 3. Box-Form Cameras. In these last forms these instruments are excellent for hand-camera work, and they are certainly superior to Type 2, as the bag changing mechanism with which they are usually fitted is not so prone to dust as is the case with automatic changers. Of late years, however, cameras have been wanted with a greater range of movements than the box cameras afford, and they have been almost superseded by Types 4 and 7.

Type 4. Reflex Cameras. These cameras were produced primarily for those who wanted to get the exact focus of extremely near objects, or to photograph objects moving at a high rate of speed, but the fascination of viewing the actual object that was being taken on a full sized finder has made them very popular with a much larger class. In general design they consist of a box in which is a mirror behind the lens, reflecting the image on to a ground glass in the top of the camera, and this ground glass is usually covered with a viewing hood. To make the exposure, on pressing the release, the mirror which is pivoted at its upper end flies up to the top of the camera, and in so doing releases the shutter, which immediately takes the picture. Such cameras, to be reliable, must necessarily be expensive, as there is much mechanism in their construction.

In the last edition of this Handbook we pointed out the disabilities of the Reflex cameras as then made and which all had focal plane shutters. We stated that the Focal-Plane Shutter, although very suitable for high-speed work, was not the best for general pictorial work. Moreover, it is likely to produce dust, and consisting, as it does, of fabric coated with indiarubber, perishes quickly in very hot or very cold climates. And perhaps the greatest drawback is the unsuitability of the camera for the work for which it is primarily intended, namely, the photography of near objects—at least unless such objects are at rest. The shutters as fitted, work perhaps from 1/1000th of a second to 1/15th of a second. To make this type really serviceable the shutter should be of metal and exposures should be possible, say, from $\frac{1}{4}$ to 1/100th second, in addition to time exposures. It is very rare that a higher speed than *an actual* $\frac{1}{100}$th is required, in fact in my own experience I rarely require less than $\frac{1}{32}$nd, and use constantly $\frac{1}{4}$ and $\frac{1}{8}$th second."

When these lines were penned we had no idea that what appeared an unsolvable problem would so soon be solved. For to better understand the difficulties in the way of successfully making a reflex camera with an efficient diaphragm shutter it must be remembered that light comes into the camera, not only through the lens, but also through the ground-glass finder on the top of the camera. In the Focal-Plane type the lens is always open and the reflecting mirror acts as a cover for the ground-glass finder while the shutter is released, and consequently only light passing through the lens can reach the plate. To dispense with the Focal-Plane shutter.

The Seven Problems were as follows :—

1. That the lens should be open when the mirror was down and the shutter set.

2. That no light should reach the plate through the lens while the mirror was in motion.

3. That no light should reach the plate through the ground-glass finder while the mirror was opening.

4. That the shutter should work at any desired speed without loss of time after pressing the release.

5. That the shutter could not be set when the mirror was up.

6. That the shutter must of necessity be set when the mirror was down.

7. That the shutter must work equally well when the rising front was in use and also when at any focus.

We discussed the problems with Mr. Arthur S. Newman, whose reputation as an originator of apparatus of the highest quality is world-wide, and he has overcome every difficulty in so simple and satisfactory a manner that it now seems almost impossible to realize that there was any complexity in the work which was undertaken.

In the Newman and Sinclair Patent Reflex there are no blinds whatever, and it embodies everyone of the points suggested above as necessary for the perfect Reflex.

TYPE 5. FOCAL PLANE FOLDING CAMERAS. The general design of these cameras follows that of the Zeiss "Palmos" and Goerz "Anschutz," and they are particularly favoured by professional photographers who have to take pictures of rapidly moving objects for press purposes—in fact, to a professional doing such work, a camera with a Focal Plane Shutter is an absolute necessity. These cameras are compact and can be used with dark slides, changing box, roll holder or Film pack adapter. Of course, anyone purchasing these cameras must recognise the limitations of the Focal Plane Shutter. It is admirable for high speeds, but not good for slow ones; tends to make dust and has not the life of a diaphragmatic shutter.

The available amount of rising and cross front on this type is small, and although such cameras may be used on a stand, they are really designed for high-speed hand-camera work.

TYPE 6. POCKET AND COMPACT FORMS. Certainly the most portable of all small cameras are the "Goerz V.P. Tenax," "Zeiss Bébé," "Block Note," "Vesta," and "N. & G. Baby Sybil," and these, when fitted with the Zeiss or Goerz Lenses, give perfect negatives, which, though only $1\frac{3}{4} \times 2\frac{5}{16}$ in size, will stand an enormous degree of enlargement. It is really astonishing to what an extent the small plates taken with these instruments will enlarge.

Most of these cameras may be had of similar construction but larger in size, and those taking plates $3\frac{1}{4} \times 2\frac{1}{2}$ are very popular. There is a large sale also for such sizes as take plates $4\frac{1}{4} \times 3\frac{1}{4}$ and $5\frac{1}{2} \times 3\frac{1}{2}$.

TYPE 7. UNIVERSAL CAMERAS FOR HAND OR STAND, of which the best known are the "Sinclair Una" and the "Sanderson." These cameras consist of a box with folding baseboard which, when opened out at right angles to the body of the instrument, supports

the lens-carrying front with the bellows attached. Such cameras are light and fairly compact, and their available range of movement is greater than that of any of the other forms, and consequently they are very suited to the worker who wants to do the best work, whether in hand or on stand.

The advantages of this type *when properly made* are as follows :

Almost any lens can at will be used and changed instantaneously for one of a different focus.

The range of movement permits of a great rise being used—an important matter in architectural photography.

They are well adapted for Tele-photo work.

Any shutter, including Focal Plane, can be used, the latter preferably as a supplementary shutter.

Any plate or film-changing device can be fitted, consequently the same camera is suitable in all cases.

It is a form well suited for colour photography.

A great convenience to this type has recently been added to the "Sinclair Una" in the form of revolving back. This enables the plate to be instantaneously changed from the vertical to a horizontal position and *vice versa*.

HINTS ON SELECTION.

The foregoing matter will give some idea of the various patterns and perhaps it would not be out of place to say on what lines the reader should be guided in selecting an instrument.

FIRSTLY. BUY THE BEST OF THE KIND YOU WANT if you can afford it. Economy with the instrument is generally false economy, and a camera is as a rule worth what it costs, providing the makers are firms of repute. This does not mean that the most expensive is the best for your purpose, for your aim may be limited in scope. It is of no use buying a Gatling gun to kill a rook, but on the other hand, a rook rifle would be of little use in warfare. Decide on the limits of your work and then buy the best within those limits.

SECONDLY. BUY THE SIMPLEST, and this will probably not be the lowest in cost although cheapest in the long run. Camera makers are much like dressmakers. The cheap article has a superfluity of trimming to hide its defects. Should you only have a limited amount to spend and two instruments are listed at the same price, one on which every conceivable contortion is possible and with triple extension and the other simpler and consequently more last-

ingly rigid in design, then choose the latter. It will be doing good work when the former is firewood. Care in obtaining the best instrument will save many pounds in materials.

THE USE OF THE HAND CAMERA.

Having purchased your camera, consider its use seriously. Even if it is the cheapest possible instrument good work may be done, if you will recognise its limitations and understand its capabilities. Many beginners are extremely surprised and mortified when they find that the first dozen plates or films they expose are worthless because of movement or under-exposure. Did not they buy a camera with "instantaneous lens and shutter?" Then how can the pictures be shaken and why are they under-exposed?

Study Makers' Instructions. The first thing to do is to carefully examine the instrument, *at the same time* studying any instructions for its use issued by the makers. Many cameras, with Focal Plane Shutters especially, have been placed out of order by the purchaser forcing or winding some screw of which he did not know the use. Learn every detail about your instrument, as well as its limitations.

Examine your Shutter. I have for years preached to makers of shutters and tried to get them to restrict their imaginations regarding the speeds at which their shutters work. They always say that the public does not want to know the actual speeds but only what they think the actual speeds should be. So when one large manufacturer marks a shutter actually working at 1/35th as 1/100th second another maker whose shutter works at perhaps just over 1/100th second marks it at 1/300th just to keep the proportion right. The best thing for the serious photographer is to get his shutter tested by such an institution as the National Physical Laboratory and obtain what still goes by the name of a "Kew Certificate." Seeing that all exposure tables with rapid plates are dealing with fractions of a second it is really advisable for the photographer to have something within 50% of accuracy. A new shutter, the Newman and Sinclair "Accurate" is now announced, and the makers state that each one will be issued with a Kew Certificate. This is a step in the right direction, but whether it will be popular with the makers of plates or films is another matter for a large proportion of their present output is wasted by incorrect exposures.

Test the Focussing Scale. Place the camera on a table or stand and focus a distant object on ground-glass screen or where a

screen is not supplied, put a piece of ground glass in the position which will be occupied by the sensitive surface. When the distance is microscopically sharp on the screen the index should point to Infinity, usually marked "I" on the scale, and the other distances can be tested in the same way. Convenient distances are 2, 3, 4, 6, 8 and 12 yards and Infinity. It is so easy to judge yards by taking long strides from the subject it is intended to photograph, whereas such distances as 7, 11, etc., feet are difficult to compute.

Test the Finder. While examining the camera to see if the scale is correct, look at the finder and see if the image coincides with that given on the focussing screen. Should it not do so it may perhaps be altered with a little Bates' Black or Brunswick Black, or if the image included is less than given by the plate, see what the error is, so that you may judge when taking pictures. A spot of black paint may be used for marking the current centre, for very often the centre of the finder does not agree with the centre of the focussing screen. When making these adjustments, focus a fairly distant object, for there is always a little unavoidable error in near ones.

In high-class instruments such as the "Sinclair Una" the finder is made to coincide with the view given on the plate. At a small extra cost a tilting finder is fitted with a scale corresponding with a scale marked on the rising front of the camera. This enables the worker to see the exact view in the finder that is given on the plate when the front is raised for architectural work.

The camera being examined and the lens scrupulously clean, it is loaded with plates or films and we proceed to take our first picture.

Fast v. Slow Plates. "What plates or films shall I use?" is a question put to me constantly and I invariably recommend the *fastest that can be procured,* providing they are of good quality. This advice is against all the text books and the writings in the photographic papers, but of that no matter. Writers of books are usually content to perpetuate an old legend which dates back to the days when fast plates were bad plates, and the majority of text book writers are more facile with the pen than the camera. There is no plate fast enough for me. A fast plate gives you the advantage of using a smaller stop and this allows for errors in focussing, an important matter when taking moving figures at near distances. Use a fast and backed plate for preference. A "backed" plate

is no more trouble than an "unbacked" one, providing the maker's instructions to remove the backing before development are disregarded. I am very chary of recommending that makers' instructions should be disregarded, but certainly must do so in the case of "backed" plates.

SELECTION OF SUBJECT. The camera or slides being loaded let us proceed to take our first picture and perhaps we cannot do better than select a street scene on a sunny day, and say, a couple of hours before or after noon, so that there is shadow as well as sunshine. Don't make the first attempt on the face of your dearest friend or the distant landscape which has so often given you pleasure, for such subjects are of a slightly more difficult order, and we must walk before we run.

TO FOCUS. Where shall we set the focussing scale? is the first point for consideration. If using *f*/8 stop with a 5 to 6 inch focus lens it may be set at the 12 yard mark, and if *f*/11 with a 5 inch lens at about 8 yards. Nearly everything will then be in focus, for of course in such a scene we shall take care not to have any very near object filling up the greater part of the picture. With a 5×4 or ½-plate, we shall not get so much depth of focus as with a ¼-plate, but in these cases, if we set the scale at the 12 yard mark for the 5×4 and 24 yards for the ½-plate, we shall not be very far wrong.*

WHAT SPEED SHALL WE GIVE? To give the plate or film sufficient exposure is important, and yet we must beware of gross over-exposure. With a backed plate two or three times the minimum exposure possible will not matter very much, because a good deal of the excess seems absorbed by the "backing." It may be useful to give some well-known subject and the exposure necessary under certain circumstances so that we may compare others by it. Most Britons know Trafalgar Square and the Grand Hotel Buildings. If we stand in the roadway in front of Nelson's Column and look towards the Strand, getting the Grand Hotel on the right of our picture in summer sunlight, we shall obtain a full exposure giving $\frac{1}{100}$th second with *f*/8 stop using such a rapid plate as the Ilford Monarch. With a Kodak Film, we might give $\frac{1}{50}$nd of a second, or say the fastest exposure with a "Bausch & Lomb" or "Automat" shutter, which, although marked $\frac{1}{100}$th second, is probably nearer $\frac{1}{75}$th; a speed quite fast enough for most work. In a narrower street,

*See Table in Appendix.

lit by good summer sun, I should recommend $\frac{1}{32}$nd with *f*/11 and the fastest plates. In narrower oriental streets such as Cairo, $\frac{1}{16}$th with *f*/8 would probably be more nearly correct.

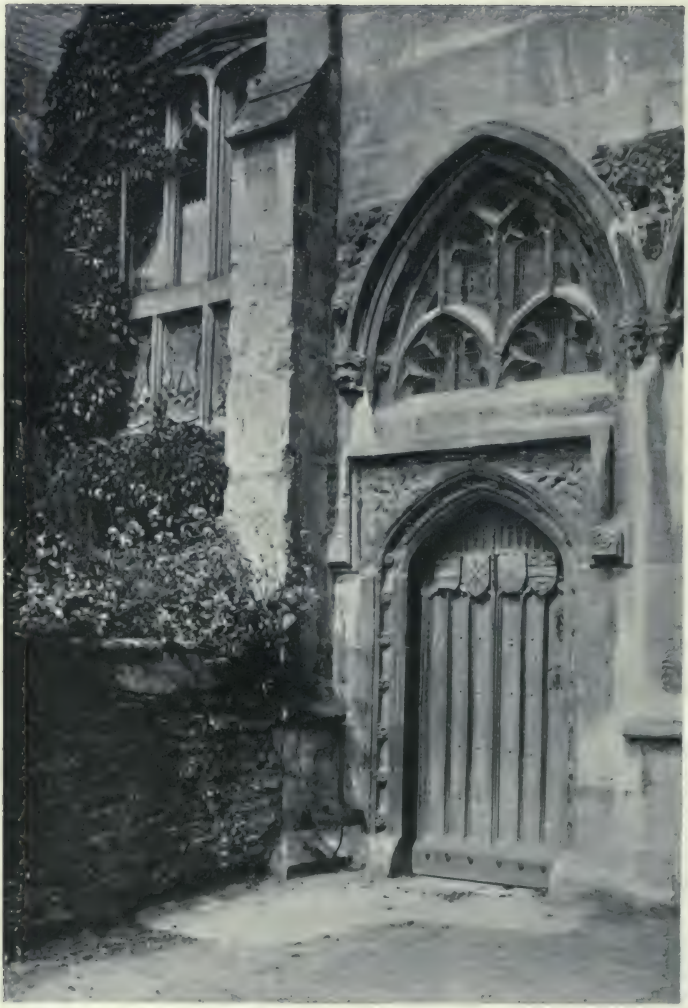
TAKING THE PICTURE. Having selected the subject and composed the picture to the best advantage in the finder, with a due proportion of light and shadow, we *hold the camera level* and probably raise the front to cut off some of the foreground, and, then when all is ready, "press the button" and take the picture. The way the button or shutter release is pressed is most important and more mistakes are made by beginners over this simple operation than from any other cause.

THE GOLDEN RULE. When pressing the shutter release, remember the golden rule and "HOLD THE CAMERA STEADY." It doesn't matter where you hold it, under your right arm, or under your left arm, or in front of you, provided you *hold it steady*. Don't imagine that a quickly moving object requires you to jam down the shutter release with force, such force has no control over the speed of the shutter. Always press deliberately, firmly, and without any jerk. A steady direct pressure is what is required and the lighter the camera the more likely you are to fail at the first attempt.

Then having taken the picture, at once change your plate or film so that you are ready for the next exposure. Get into the habit of doing this at once and it soon becomes quite automatic.

If you take your first picture on the lines indicated, I can promise you success. You may afterwards experiment with more difficult subjects and provided you have a good camera with a good lens, good finder and good shutter, and combine them with brains, you will find few outdoor subjects which you cannot photograph as well with a camera held in the hand, as the deliberate worker who feels it essential to have the support of a tripod stand.

J. A. S.



CHAPEL DOORWAY,
VICAR'S CLOSE, WELLS.

C. H Hewitt, F.R.P.S.

Taken with the Sinclair "Una" Camera.

CHAPTER VII.

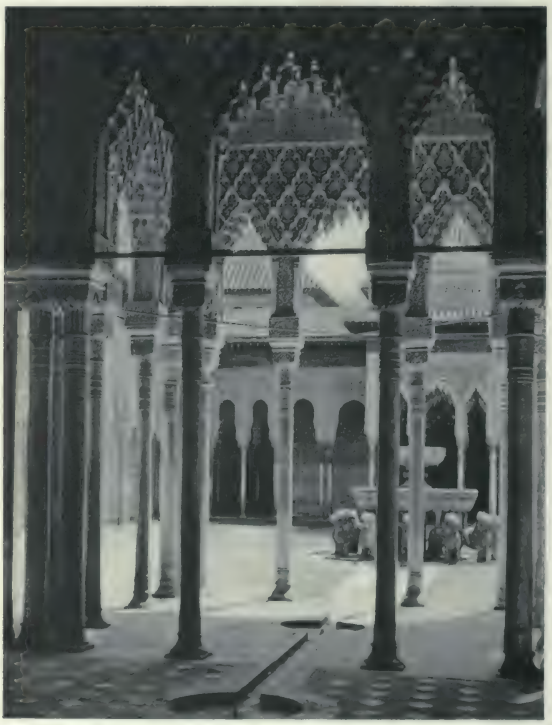
The Hand Camera and its Possibilities.

By JAMES A. SINCLAIR, F.R.P.S.

We live in the hand-camera age, and as modern photography is the apotheosis of the snap-shot, it may seem late in the day to write an article on the possibilities of the Hand Camera. Perhaps it would be better to discuss the impossibilities were it not for the fact that the old legend "that for serious work a stand camera must be used" is supported by a conservative but rapidly diminishing school of photographers who will not take the evidence of their senses and who are under the impression that the Hand Camera is only a "Kodak" with a very limited sphere of usefulness. For my part I am prepared to assert that the Hand Camera will do nearly everything that the pictorialist requires, and, generally speaking, will do it better than the stand camera. There is hardly a book of travel published to-day in which we do not gain quite as much information from the snap-shots with which it is illustrated as from the literary descriptions of the author. Our daily and weekly press would, indeed, largely cease to exist were it not for snap-shot illustrations. The snap-shot to-day will mirror this epoch to future races in the most realistic fashion.

I would ask each user of a hand camera to help in the practical history of our own times by systematic work, and it is easy to do this without any great effort. The first thing to aim at in this direction is good technique, and this is not difficult to secure providing the Hand-Camera worker will understand his instrument and recognise its limitations. For instance, a camera with a focal plane shutter will admirably portray athletic pursuits, horse and cycle races, diving contests and accurately record very rapid movements, but may utterly fail on many subjects which are quite possible with cameras having good diaphragm shutters giving such speeds as

$\frac{1}{8}$, $\frac{1}{4}$ and $\frac{1}{2}$ second. Nearly everything is a question of compromise, and to do the best work we must recognise the limitations of our instrument or the materials in order to get the best out of them. Films are usually slower than plates, some cameras have but little movement to the rising front, and others may have slow lenses, yet by suiting our subject to the conditions, good work may be done.



COURT OF LIONS, GRANADA. *Jas. A. Sinclair.*
Taken with Camera held in the hand.

Having mastered the question of technique, it is important to work with a definite purpose, and, firstly, I would suggest collections of scenes of everyday life. For instance, what could be more delightful than for parents to photograph their children in the various stages of their growth, together with the home surroundings, binding such prints together and giving the set as a present when each was old enough to appreciate such evidence of loving thought and care.

How such work might prove :—

"That love lives on and has a power to bless
When those we love are hidden in the grave."

For my part, I have made collections of travel pictures. Even now I look over these sets with pleasant thoughts of days that are past, and of companions who are no more. Some of my books represent incidents of great national interest. For example, one little volume shows the streets of London set out for the coronation

WESTMINSTER BRIDGE. *Jas. A. Sinclair.*

of a king at a time when his sudden illness sent a thrill of sympathy throughout the land. Flags were flying, triumphal arches erected and the sun shone gaily and for my title page I used the words of "Rare Ben Jonson."

"Have not I seen the pomp of a whole kingdom—laid forth, as it were, to the show, and vanish all away in a day ?"

In these pictures are shown horse 'buses, soon to be things of the past, Westminster Bridge before the era of trams and above all, the men and women of the time.

One will do one sort of work and one another. A valuable collection might be made of street hawkers and traders. The onion man from Brittany is in our streets, but will soon be gone. The lamplighter lingers on in some places, but with the advance of electricity will soon be a *rara avis*. The old cabby on the four-wheeler is yet to be seen at the railway stations, but "fiscal reform" will not preserve him from the triumphant taxi-cab. These and many of their kind may be obtained to-day, but changes come swiftly.

Others will delight in the changing moods of our rivers, the calm of early morning or the stormy sunset. For those fortunate enough to live in London there is a never-ending source of work. It is the most picturesque city in the world, and yet is strangely neglected. I have often wanted a holiday in London, but have not dared to attempt such work where I have business, for I must confess that only by forgetting the latter can I do successful photography.

The method which I adopt for my own prints is to print ¼-plate negatives on ½-plate and ½-plate negatives on 1/1-plate platinotype paper, masking the prints so that they have white margins. These sheets of paper are then bound up so that they form the leaves of a book, and the value of the set is enhanced by an appropriate title-page. Others may prefer other methods, but in any case some permanent printing process should be selected. One very gruesome set of prints done in such a way was presented me by a friend who had a narrow escape from being overwhelmed in the destruction of St. Pierre in Martinique. He was on his way to this place for a holiday, and arrived just after the disaster, when the whole of the city was in flames. Such a set of views taken at such a time will have the greatest interest and value long after we have had our day and ceased to be.

What shall I take? is often asked. What shall I not take? is the difficult problem for anyone in any great centre of human industry and activity. I mention a list that may appeal to the dweller in Cockayne, and it could be extended and modified indefinitely, for any other place where men do congregate.

Historic London. Places that have been famous in its history. Stow's Survey of London, Besant's London, and Cassell's Old and New London, and innumerable other works will give "inspiration."

Literary London. Places made interesting by the sayings and doings of literary men.

Dickens' London.

London Street Hawkers.

London Traffic and Means of Transit.

London Markets. An endless number of pictures would be found by the early riser in Covent Garden or the Borough.

London Churches. (The stand may be wanted for interiors.)

London Statuary.

London Doorways.

London Fountains.

London Inns.

These are suggestions. A moment's consideration will reveal other nuggets in this mine of wealth. Then, when taking holidays, how pleasant it is to have reminiscences in some permanent form, and a set can easily be made including all seen and done. The educational value of the hand camera soon becomes apparent, for the things photographed are not only seen but remembered. When forming holiday collections I strive to make them entirely representative of the country and people, and include physical characteristics, architecture and local manners and customs, at the same time portraying them in as pictorial manner as possible. By so doing every incident of the holiday or journey is brought back in the most vivid fashion even after many years.

Bearing these things in mind, and working with definite aim, the possibilities of the hand camera are endless and its careful use will add to the pleasures of life now and its interest to posterity.

TENBURY CHURCH.

Taken with the Sinclair "Una," held in the hand.

CHAPTER VIII.

The Camera at Home.

E. T. HOLDING.
From a Snap-Shot by Jas A. Sinclair.

By E. T. HOLDING, F.R.P.S.

There is a widespread superstition amongst the inexperienced in matters photographic that it is easier to do landscape than figure work. The natural consequence of this mistaken notion is that for one amateur who interests himself in the photographic study of figures and faces there are a hundred who devote their attention entirely to landscape. The latter regard the camera as merely a holiday companion, whose vocation it is to make a more or less pictorial record of places visited and of scenes that had attracted by their natural charm. Even those whose appreciation of the beautiful leads them to produce beautiful photographic landscapes, rarely seem to develop that instinct in the appreciation of what is beautiful in the human form—or, at any rate, they refrain from giving photographic expression to it. Perhaps they have been abashed by the fearful and wonderful groups, figures, and poses to be met with in many amateurs' collections ; perhaps they have gazed with horror upon the work of the local professional ; or, peradventure, it is a fear of ridicule that holds them back—a dread of those ancient, time-worn jokes about the havoc and distress caused by the amateur photographic portrait ! Yet it would be a pity if such things deterred one who saw beauty, or thought he saw it, from attempting to portray it—a pity not only that the photographer himself had been denied the joy of perpetuating that particular thing of beauty, but a pity also that the contemplation of it had been denied to all those who would have seen his production. For a thing of beauty, even if it be merely a photograph, is a joy for ever.

Why it is that figure work is thus regarded as so much more difficult than landscape has puzzled me since I first possessed a camera. For to the making of a good landscape photograph there goes an infinitude of knowledge, and of circumstance beyond the control of the photographer. He may cover leagues of country before he finds a composition that pleases him—and then may find the lighting is all wrong for his purpose. But in making figure studies he may pursue the even tenor of his way in his own room or garden—quietly and uninterruptedly planning his effects, master of every detail he wishes to introduce. He may (if he is *not* in his garden) defy the elements, and instead of scouring the country-side for happy compositions, find his ready-made under his own roof-tree—or make them himself.

Another superstition regarding this branch of work is that the necessary outfit entails the expenditure of vast sums of money in special lenses, special cameras, and a host of other special accessories. I grant that the photographer who is "so dispoged" may lay out a very pretty sum upon such matters, and with advantage to the scope and quality of his work and his comfort in doing it. But (if Mr. Sinclair will allow me) I should like to say that I have seen much beautiful figure work and portraiture done with a guinea camera. Indeed, the most precious and indispensable item in a photographer's outfit is a *knowledge* and *appreciation of what is beautiful*. With this knowledge he will make beautiful photographs with whatever camera he may have at hand. Without it, the most perfect and exacting lens that science can produce will do no more than render with added faithfulness and truth the extent of his failure.

Granting, then, the possession of this quality, the next most important is to have a lens that will allow you to give expression to it. On this point I am ill qualified to advise. Nor, indeed, is advice from others very necessary—for it is probably best for each writer to formulate his requirements upon his own experience, and get the lens that will best meet them. The lens is regarded with considerable awe by most amateur workers. It is, for those unversed in the laws of optics, a thing of mystery. I once asked an enthusiastic beginner in photography why she never tried figures or portraits. "Oh," said she, "I have only a landscape lens." I hastened to ask her what the difference might be between a landscape and portrait lens—and her reply led me to believe that she entertained the idea that they were so totally different that portraits taken with

a landscape lens might almost be expected to look like trees ! The chief difference between a portrait and landscape lens lies in the aperture at which they work.

The portrait lens must work rapidly and give the quickest possible exposure ; and this, of course, is done by designing it to work at a larger aperture, *i.e.*, one admitting more light than is necessary for landscape work. If the portrait lens designed to work at *f*/4 or *f*/5 is stopped down to *f*/8, there is then no difference between it and a landscape lens working at the same aperture, given the same focal length and quality of definition. Most beginners in portraiture naturally use the lens they have been in the habit of using for their landscape, and frequently with such satisfactory results that they continue in its use—trusting to the rapidity of the plate they use for a short exposure. For, of course, a matter intimately connected with the length of exposure is the speed of the plate used—and in this matter we are much better off than we were a few years, or even a few months ago. Most of the standard makers have a selection of speeds—from slow to very fast—giving great latitude in exposure.

If we take, for instance, the Ilford Co.'s plates, we find that where their *Ordinary* plates would require 4 seconds' exposure for a given subject, their *Special Rapid* will give the same result in $\frac{3}{4}$ of a second, their *Zenith* in $\frac{1}{2}$ of a second, and their *Monarch* in $\frac{3}{8}$ of a second. The cost of the plates introduces another factor needing consideration in the selection of a lens when much portraiture or figure work is to be done, and if the matter of cost is one to be taken into consideration.

As we find the most rapid plates cost from 25 per cent. to 33 per cent. more than the slower varieties, will it be worth while purchasing a rapid lens (with its many other advantages) in order that we may use slower and cheaper plates ? Each worker must be left to answer this conundrum for himself—and he will find the subject full of interesting side issues. For instance, a large aperture in a lens means a comparatively heavy lens. A whole-plate lens working at *f*/4 is a much more imposing piece of furniture than one working at *f*/8. The latter can be carried in a waistcoat pocket, and, consequently, can be used in a light field camera. The former approximates to the size of a bucket and needs a camera built like a fortress to carry it !

Some prefer doing their work in ¼-plate size, such negatives as result in success being enlarged to a more agreeable scale. This method has its advantages and disadvantages. The economy effected is obvious—and the results obtained have a certain softness and breadth due to the enlargement. But it is certainly more agreeable to work on a larger plate. The picture can be seen more clearly on the screen and can be more easily criticised and corrected. But here, again, *experientia docet*, and the worker starting with such instruments as he already possesses will develop on his own lines. He may eventually become the proud possessor of a complete studio outfit—or may find that a whole-plate field camera on an ordinary tripod will do all he wants. The most useful camera I possess is a portable double extension 1-1 field camera fitted with turntable, rising and falling front, and swing back. In it I use a Ross ½-plate universal lens working at *f*/5·6 focal length. This lens, while not too heavy to be carried by the camera when fully extended, easily covers a whole-plate with a ¾-length portrait or group, such as is illustrated in Fig. 1. By using the first or back combination alone, as a single lens, it will give a larger head than can be got on to a whole-plate, and this without distortion. The result is that working in an ordinary-sized room I can get with the same lens either a head that will fill a whole-plate, or a full-length figure in a half-plate, and anything between these two extremes. The camera itself is light enough, in its case, to be carried a moderate distance without causing fatigue, and small enough to be easily attached to the carrier of a cycle. The event that led to the purchase of this particular camera was the attempt to take portraits at home with a quarter-plate magazine camera which possessed no focussing screen, and could not be racked out to focus anything nearer than 4 yards. This was balanced on a chair, and the exposure made with more hope than faith. Preliminary experiences of a similar kind will doubtless lead others to realize their requirements.

The absence of a studio proves an obstacle to many who would like to do portraiture. But those who do not possess a specially-lit studio for their work are not under such a great disadvantage as might be imagined. The lighting of an ordinary room is quite capable of affording good results, and with the aid of simply-contrived curtains and reflectors can be made to suit almost any purpose. And when the possessor of a camera has experienced the joy of making a passably good figure picture, he will discover that his domestic

surroundings are full of interesting lightings and pictorial suggestiveness. Further, he probably has a garden or some open air space at his command which can be enlisted in the service of his art, and no better place than the open air can be found in which to start portrait work, and this for two reasons. In the first place, the problem of lighting is beyond the control of the operator and need not, therefore, trouble him. And, secondly, the question of the correct exposure can be easily ascertained, and will, at the same time, be found to be much shorter than would be necessary indoors. These two facts will make the first essays easier, and will enable the beginner to concentrate

E. T. Holding.

THE FAIRY TALE.

his attention on the pose and management of his sitter. Of the principles that should guide him in these matters it is not for me to speak. They will be prompted by his own knowledge and taste. All I would suggest is the elimination of all unnecessary detail—the simplification of the subject with a view to bringing out its essentials. In the matter of backgrounds, for instance, how many amateurs come to grief. One is reminded of the reply of Reynolds to the mother who brought her son to learn painting, and suggested he could probably begin by painting in some of the master's backgrounds

"Madam," Sir Joshua is reported to have said, "if your son can paint my backgrounds I have little to teach him." Who has not seen a family portrait taken by some enthusiastic amateur photographer posed against a brick wall! In such cases, in order that nothing should be lost, the sitter's boots are generally included, and, if possible, a rain-water pipe also.

The inclusion of these details does not infer so much a love of boots, bricks and water pipes, as a lack of forethought in arranging the picture. For open-air portraiture a plain background is almost

E. T. Holding.

BUILDING THE BRIDGE.

a necessity—trees, bushes, ivy-covered walls, or fences are all more or less incongruous. The tint of the background may be anything from black to white, but, generally speaking, the lightest is the best—it will suit your subject—for the open-air lighting of a face is very delicate, and against a dark background is apt to look white and flat. Care should be taken that the folds or texture of the background are not discernible on the screen—so that merely tone and not detail are rendered. If your subject is a child it will be neces-

sary to arrange that the exposure should not *exceed* half a second, as children do not generally sit perfectly still for a longer time. This can be done by consulting your exposure meter, and arranging your stops and plate to suit the case—for the shorter the exposure in such cases the greater the chance of success. Speaking in *very* general terms, for an open-air portrait, taken on a special rapid plate, using stop *f*/11 on a dull day, the exposure should be about ½ a second. The result of exactly such conditions is shown in the illustration, "The Fairy Tale." It is well to reduce the exposure to the shortest possible, as even adults do not really enjoy sitting perfectly motionless for the 20, 30 or 40 seconds which some of my friends boast is the exposure they like best to give! Where the conditions demand exposures of such length it is the part of mercy to refrain from operating.

For indoor work the correct exposure requires very careful consideration. The shadow side of the face, etc., must receive adequate exposure or it will print as a black mass. Your exposure meter should be placed in such a position that it receives only the light that the shadow side of faces receives. It is a sound and well known axiom in photography that we should expose for the shadows and let the high lights take care of themselves. In portraiture, however, measures must be taken to prevent harshness, and the development of the plate must receive special attention, more particularly if the scheme of lighting adopted be one giving strong contrasts. In order to prevent undue opacity, *i.e.*, over-development, in the high-lights of the negative, the developer should be diluted to half its normal strength, and should have a larger proportion of the accelerator. A portrait negative, in all but exceptional cases, should be soft. The tones should be delicately gradated. Development, however, cannot be relied upon to overcome errors of lighting and arrangement. If the shadows in your subject are so dark that it is hopeless to expect to be able to give them adequate exposure without the high-lights overdoing, we may fall back upon the use of reflectors. They must, however, be used with care and judgment. It is enough to hang a sheet of white paper or a white cloth in such a position that it reflects sufficient light to reveal detail, but not sufficient to resemble a second source of light. Reflectors are also useful in throwing light into those places which in an ordinarily lit room would photograph as regions of utter darkness. Sometimes a figure, lighted from a window, shows adequate illumination in the upper

part, whilst the lower part descends into impenetrable gloom. A little light, thrown from some white reflecting surface, may just suffice to reveal detail, and, if so, the reflector may be used with advantage.

If it is intended to use part of the room, or its furniture, as a background, care must be exercised in the disposal of such features as will appear in the picture. In itself, the room may be a model of good taste in its furnishing and arrangement, and still be unsuitable, without some rearrangement, as a background for portraits or genre subjects. It is well to err on the side of simplicity in such accessories as are introduced, and their position and colour or tone are of vital importance to the composition. It may be a picture on the wall, or a bowl filled with flowers, or an architectural feature of the room—whatever it is it should help and be subservient to the prime motive of the composition. It is of great assistance, in judging the correctness of an arrangement, to use a small mirror, held at right angles to the ground-glass screen, in which the picture will be reflected right way up. One cannot always form a correct judgment of the composition when it is only seen upside down. If the camera faces the source of light (window, doorway, etc.), backed plates should be used. Some workers never use anything else, but it seems unnecessarily luxurious to use them, except where they are wanted, and I have not discovered that they give better results than an unbacked plate with ordinary subjects.*

Working at comparatively close quarters to your subject, it is necessary to use a stand that can be easily raised or lowered. With a regulation studio camera this is, of course, a very simple matter, but when a tripod is used the best form is that in which the lowest division of each leg telescopes into an upper one. It is then possible to lower the camera without unduly spreading the legs of the tripod, a proceeding fraught with danger when working on a hard or polished floor.

As I have already said, it does not come within my province to speak of method of posing or arrangement. Such matters depend entirely on the character of the sitter, or the idea to be conveyed in the picture, and must be left to the individual taste of the artist. One word of advice may not be out of place, namely, arrange as many preliminaries as possible before asking your model to sit.

* Mr. Holding's remarks seem to show that he has rarely used backed plates.—Ed.

Having a more or less definite idea, before commencing operations, of the arrangement you are going to photograph, there is no reason why the background and accessories should not be placed approximately in their right positions before the model is introduced. At the last moment such slight re-arrangements as are necessary can be made without unduly wearying your sitter.

It is a wise plan to keep your dark backs loaded with rapid plates, and your camera near at hand, so that you are prepared at a moment's notice to make a photographic note of any accidental pose, or lighting, that attracts you by its beauty, and which it might not be easy to have repeated. In this way one may secure many unstudied and natural effects that are far more charming because of their spontaneity than compositions that have been more laboriously arranged. Particularly is this the case with children, who do not take kindly to being carefully posed and arranged, but who, if caught in natural moments, will give you subjects far better than can be deliberately planned.

And now, having touched but the outer fringe of a great and fascinating branch of photographic and artistic work, I must leave it with this assurance that whosoever has eyes to see that which is beautiful cannot fail to make beautiful photographs; and that, if he but face the difficulties that exist in this, as in every other branch of work, he will open up for himself a new world of delightful study.

E. T. HOLDING.

Two photographs taken with the N.S. Patent Reflex without moving the position of the camera. The upper one is with the 6-in. lens, as normally fitted to the ¼-plate, and the lower with the Tele-lens, which is held inside the camera when not in use.

CHAPTER IX.

Flashlight Photography.

F. J. Mortimer, F.R.P.S.
By Furley Lewis, F.R.P.S.

By F. J. MORTIMER, F.R.P.S.,

Editor of the "Amateur Photographer" and "Photographic News."

The production of photographs by magnesium light, commonly known as flashlight, is possibly one of the most fascinating phases of modern camera work. It places a new power in the hands of the photographer, and renders him independent of daylight, but at the same time it is probably a form of photography that is little known and less understood by the average picture maker. It is not a difficult branch of the art, although its pitfalls are numerous. It is, however, because of its apparent simplicity that disappointing results are so frequently obtained.

These results have commonly been produced by those workers who have not thought of the rudiments of the subject, but have started with the mistaken idea that flashlight has singular properties of its own not peculiar to other forms of lighting.

There are, of course, instances where certain subjects can only be treated by means of flashlight, but these are thus treated either because of their environment of time and place, or because daylight is not possible, or inadmissible, *i.e.*, flashlight work in mines, stage photography, etc.

To start at the beginning, therefore, a general rule to be observed is that, apart from the actinic value of the light used, the most successful and pleasing effects are always obtained if the

conditions, as regards the direction of the light, are made similar to those followed in daylight portraiture. Ninety per cent. of flashlight negatives are of portrait or figure subjects. Eighty of those ninety can usually be recognised immediately as flashlight productions, and their characteristics are not in their favour. They appear harshly lit, with crude shadows and hard cut-out outlines. Why is this? Simply because the methods of lighting that would have been employed had daylight been the illuminant have been ignored.

Were it possible to focus the subject on the ground glass, illuminated by the actual flashlight, these errors of lighting would not occur. Experience, therefore, will be the chief guide for the flashlight photographer, and a method of trial and error his most practical instructor.

THE LIGHT.

This may take the form of either a flash lamp or a flashlight mixture—ignited by the application of a spark or flame. The flashlight is, of course, generally used at night.

Magnesium is usually the base of most descriptions of flashlight. Magnesium wire or ribbon is of very little use for the purpose, as it burns but slowly and its illuminating powers are restricted. In the form of powder or dust, magnesium burns very rapidly when brought in contact with a flame and gives an intense white light. It can be made to burn even more rapidly and completely if intimately mixed with some chemical substance rich in oxygen—such as chlorate of potash, but as these mixtures really constitute explosives they should be treated differently from plain magnesium powder and never used in a flash lamp.

The best form of flash lamp for general purposes is that known as the "blow-through." It consists of a reservoir with the lamp attached. The reservoir contains a supply of pure magnesium powder. A sufficient quantity of this powder to make a flash is blown through the flame of the lighted lamp. The flame is formed by burning cotton wick or other suitable substance soaked in methylated spirit, and is attached to the orifice through which the magnesium is blown. Pressure on a pneumatic ball attached by a tube to the reservoir serves to blow a charge of the powder into the flame to make the necessary flash.

With some lamps an accumulator for the air, similar to that

on the familiar scent spray, is used to drive a continuous stream of magnesium into the flame and so produce a prolonged light.

The application of a lighted taper to a flashlight mixture causes a brilliant and instantaneous flash, but to ensure the best results the mixture should be spread on a train of gun cotton.

Gun cotton or pyroxylin is sold by most photographic dealers and chemists, and is quite safe to handle under ordinary conditions. Its use is advocated as not only ensuring a more complete combustion of the flash mixture, but also because the best results are obtained when the light is spread over a broad area. The flash is also more rapid.

Plain magnesium may also be fired with a lighted match or taper if spread on gun cotton, but the flash is not so quick or brilliant as with the mixture.

FLASH POWDERS.

Flashlight mixtures and powders should be handled with great caution, as they are frequently explosive if treated roughly. The following commercial flash mixtures can be recommended :—"Argentorat," "Agfa" flash powder, "Ideal" flash powder and Bayer flashlights.

The best home-made flashlight mixture is made as follows :—Sift magnesium powder (3 parts) on a sheet of paper ; and powder potass. chlorate (6 parts), and antimony sulphide (1 part) *separately* to the finest powder. Mix all with a feather or the dry finger, or shake together in a cardboard box. Seven grs. burn in from 1/20 to 1/40 sec. Each ingredient should be perfectly dry. *Never use a flash mixture in a reservoir lamp*—only plain magnesium.

THE EXACT AMOUNT OF FLASHLIGHT

necessary for producing perfect results depends upon four conditions—the speed of the lens, the colour of the object photographed and the surroundings, the speed of the plate and the distance of the light from the sitter. The following will be found a guide when a rapid plate, say, 200 Watkins, is used ; the lens working at *f*/8, the sitter wearing moderately light clothes, and the walls of the room not being very dark. At a distance of 5 feet from the head of the sitter use 12 grains of flashlight mixture. At a distance of 10 feet use 30 grains. At 15 feet use 70 grains and at 20 feet use 100 grains.

PLATES.

It is advisable under all circumstances to employ rapid plates for flashlight work. In fact, the more rapid they are the better, if soft results are desired. They should be backed to avoid any chance of halation from white collars or drapery, etc., and orthochromatic plates possess advantages if the subject has a pronounced colour or freckles, although the use of a colour screen is rather out of the question for the average worker of flashlight portraiture. If ultra rapid plates are used it is possible to cut down the amount of flash powder or use a smaller stop in the lens.

THE POSITION OF THE LIGHT

is always a difficult question, but it may be taken as a general rule that an angle of 45° should be followed as regards height and distance from the sitter, while the position of the light in front or behind depends on the type of portrait required. An imaginary square should be drawn thus (Fig. 1):—The head of the sitter should

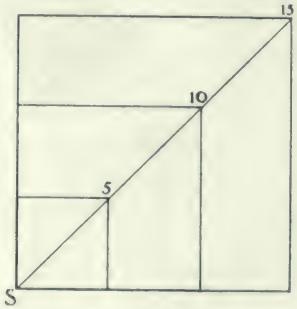


Fig. 1.

occupy a bottom corner. The best average lighting will be obtained by the light being placed anywhere on the diagonal drawn from the head at the opposite corner. It should be borne in mind, however, that the nearer the light is to the sitter the harsher the shadows will be, while the further off it is—provided the quantity of powder is increased proportionately—the greater the possibilities will be for diffusing it.

THE COLOURS OF THE WALLS

and decorations in a room, also the colour of the dress of the sitter have a bearing on the quantity of flash powder necessary, and it is advisable to double the powder in case dark colours prevail. Before

fixing upon the position of the light when making a flashlight portrait it is a good plan to use a portable light, such as a good oil lamp, and study the sitter under different conditions of lighting.

All other lights should be turned down in the room and the effect produced on the sitter when viewed from the standpoint of the lens by placing the lamp at different points will be approximately that produced by the flashlight.

A little higher or lower will make a great deal of difference with some portraits. In case of deepset eyes or hollow cheeks, do not place the light too high, but in taking a group it is desirable to have the light as high as possible, so that any shadows cast by one person will not fall on the next.

In any case the position of the light should be such that the effect will resemble as closely as possible the lighting from a studio skylight, and the little diagram given (Fig. 1) indicates roughly what this angle should be.

THE RELATIVE POSITIONS

of sitter, flashlight and camera are indicated in the following diagrams. Figure 2 shows a good arrangement for the production

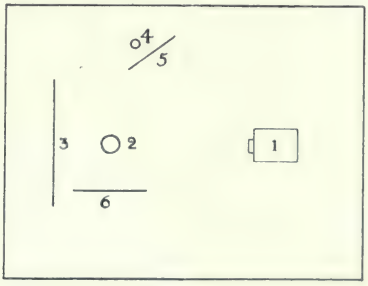


Fig. 2.

of a pleasingly lit portrait with a single flash lamp or one ignition of flash powder on a tray ; 1 is the camera ; 2, the sitter ; 3, the background, if one is used (placed about 4 feet behind the sitter) ; 4, the flashlight (8 feet above the floor, if possible) ; 5, a small screen placed to prevent direct light entering the lens from the lamp ; 6, a reflector to lighten the shadow side of the face, *e.g.*, a piece of white card or paper, or a sheet thrown over a clothes horse or other convenient holder. If flash powder is used, a tin tray or lid of biscuit box forms a good receptacle and a gun cotton train should be spread from side to side. A high pair of steps will answer as a support

for the tray, and if a little of the gun cotton protrudes over the edge this can be ignited with a lighted taper when all is ready. Care should be taken, however, not to put the flashlight too near the ceiling.

The sitter after being posed—in any case not looking at the light (a pleasing effect is obtained by looking at the reflector (6) and allowing the direct light to fall on the back of the head)—is focussed by the aid of a lighted taper or candle held by the sitter near his face, which can then be seen distinctly on the focussing screen. Use the largest possible stop giving reasonable definition—say, *f*/8.

Let off the flash—the lens remaining uncapped during the entire operation of inserting the dark slide and pulling out shutter, and with from 10 to 20 grains of flashlight mixture or a firm, quick pressure on the bulb of the blow-through lamp—a good portrait should be obtained.

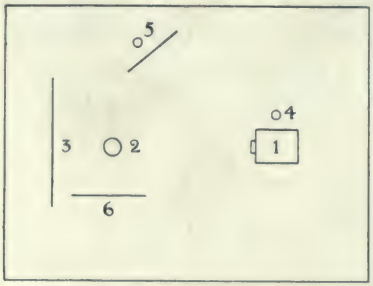


Fig. 3.

THIS EXTENSION OF THE FLASH

is a point that cannot be too strongly urged if the best lighting is desired. This is especially essential when photographing groups or large rooms. For this reason two flashlights placed in the proper positions for correct lighting and fired simultaneously give finer results than only one light. Experience will soon teach that a single light of small area, no matter how brilliant, will give harsh shadows and pictures lacking the desirable roundness and gradation.

Therefore, the employment of one main flash and a smaller one at a distance of a yard or two is advised in order to get more detail in the shadows, and add roundness and "modelling" to the portrait. To a certain extent the same results can be obtained with less trouble with a single broad flash by employing a long train of gun cotton on which is spread a layer of the flash powder.

USING TWO LIGHTS TO SECURE MODELLING.

It is desirable to use two flashlights whenever possible. The accompanying diagram (Fig. 3) will show the relative position of the two lights to give a good result. Here 1 is the camera; 2, the sitter; 3, background; 4, the subsiduary light—which may be placed on top of the camera; 5, the main light, say, 8 or 10 feet high, fairly near the sitter and screened from the lens, and 6 a reflector.

When the flashlight is placed on or near the camera, see that the apparatus is well covered with a paper or cloth—not the focussing cloth, or magnesium dust will settle and cause trouble.

REMBRANDT LIGHTING.

To secure the so-called Rembrandt effect of lighting the following arrangement is necessary (Fig. 4), and a profile portrait will

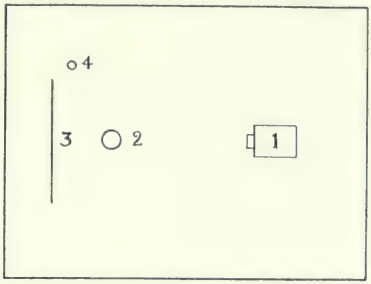


Fig. 4.

give the most pleasing result. Here 1 is the camera; 2, the sitter; 3, the background; and 4, the light—placed about 4 feet to the left, and about 1 foot behind and about 3 feet above the head of the subject. No reflector is necessary for this style of lighting, but a piece of cheese cloth stretched on a light frame can be used in front of the light to diffuse it, and, indeed, can be used with advantage with all other forms of flashlight portraiture.

A HANDY HOME-MADE LAMP

A make-shift lamp that has the advantage of being both reliable and easy to make is the clay-pipe flash lamp. An ordinary thick bowled clay-pipe of the long stemmed " churchwarden " type is used. A piece of lint, lamp wick or cotton wool is soaked in methylated spirit and loosely tied round the bowl with a turn of string or wire.

About 10 to 20 grains of magnesium powder (about an average salt-spoonful) is placed carefully in the bowl, the lint or wool is then pulled up round and over the mouth of the bowl and lighted. The other end of the pipe is placed in the mouth (hence the long stem) and a sharp puff given. The magnesium is driven through the flame, and ignites and an excellent flash results that will amply illuminate a portrait. This rough and ready means is useful when on tour. Several pipes can, of course, be connected up with rubber tubes and a ball and a bigger and more extended flash given. To secure the best light with magnesium always see that it is finely powdered and quite dry.

REFLECTIONS.

Care should always be taken that the flash is not reflected in the lens. The best way to obviate any chance of this happening is to fix to the lens a funnel-shaped hood or cone painted dead black inside.

Reflections from pictures or mirrors should also be watched for, as foggy negatives frequently arise from this cause.

For focussing, and during the actual exposure, keep all the lights in the room full on, taking care that none are included in the picture or shine on the lens ; the lens cap or shutter is therefore not required at all. When focussing a group, or a room, or machinery, etc., a number of lighted tapers or night lights should be placed to mark the boundaries of the subject, and also if they are placed at other points as well they are useful for obtaining sharp focus. These latter must, of course, be removed before putting the plate in the camera and exposing.

A tripod camera with focussing adjustments is far more likely to give satisfactory results than the box-form fixed-focus variety. The better the quality of the lens and the larger the aperture it works at satisfactorily, the more chance the flashlight will have of giving a fully-exposed picture.

THE QUESTION OF SMOKE

is always to be considered, and no flash lamp or flashlight mixture has yet been made which, if used unconfined, does not create a certain amount. Some, however, are worse than others. This is a nuisance and a serious drawback if a second or third attempt is desired soon after the first, as it is impossible to get a clear picture through

the haze. Windows and doors should, therefore, be promptly opened after the flash and a draught encouraged, to clear the air quickly.

A method of trapping the smoke is to be recommended if much work is done, and some such device as the following can be employed. A large tin biscuit box is obtained and the lid removed. The box is used on its side with the open end pointed towards the sitter. A small metal tray is suspended from the roof of the inside of the box, and upon the tray is placed a charge of gun cotton and magnesium or flash powder. A sheet of glass should be made to slide in front of the box, or if the middle of the lid is cut away, leaving only the rim, this can be used to hold the glass. A small flap door should be made at the back—opening outwards to allow the expulsion of air after the flash has occurred. The powder is fired by means of a lighted taper inserted through a small hole in the side of the box. Immediately after the flash the flap door should be tightly closed, the box removed to the open air and the smoke allowed to escape.

THE DEVELOPMENT

of flashlight negatives calls for much the same attention that hand-camera snapshots require. A developer readily giving an image free from hardness is to be recommended, and a well-diluted pyro-metol formula, as follows, has given good results in my hands :

A.	Pyro	50 grains
	Metol	50 ,,
	Metabisulphite of potash	120 ,,
	Bromide of potash	10 ,,
	Water	40 ounces.
B.	Carbonate of soda	4 ounces.
	Water	40 ,,

Use equal parts of both.

The following metol developer can be relied upon to produce a good soft negative and minimise any tendency towards harshness caused by faulty lighting :

Metol	80 grains.
Sulphite of soda	120 ,,
Carbonate of potash	240 ,,
Water	20 ounces.

Add potassium bromide if necessary.

Rodinal, Azol, Certinal, Rembrol and Victol are all soft working single-solution developers that only need dilution with water to secure excellent negatives of flashlight subjects.

RECAPITULATION.

SOME POINTERS IN FLASHLIGHT PHOTOGRAPHY.

1. Never use a flash powder in a reservoir lamp—only plain magnesium.

2. Any good fast plate that the worker is used to is the best for flashlight work.

3. Eight feet from the floor is a good height to place the flashlight for portraiture.

4. To secure the best results with magnesium powder, it should be well dried before use.

5. The well-managed flashlight photograph should not betray the source of illumination.

6. Magnesium or aluminium is the usual means of illumination in flashlight photography.

7. Always keep cool, no matter how wrong the flashlight apparatus may appear to be working.

8. For portraiture the flashlight should always be about three feet higher than the head of the sitter.

9. A backed plate will always give a better rendering of a flashlight subject than an unbacked one.

10. The blow-through flash lamp, burning plain magnesium, is the safest form of flashlight apparatus to use.

11. The light should strike the sitter at an angle of 45 degrees to secure the most satisfactory lighting effect.

12. Keep all lights burning when taking a flashlight portrait. They will help the expression when the flash comes.

13. A strip of thin celluloid—cut from an old film—makes an excellent train on which to fire a flash mixture.

14. Open the windows and doors immediately after taking a flashlight picture, to create a draught and disperse the smoke.

15. A lens aperture of *f*/8 is the most useful for all-round flashlight work.

16. Master the details of the flashlight apparatus, whatever form it takes, before approaching serious portraiture by flashlight.

17. Magnesium powder, and all flash mixtures, should be kept from the air, or oxidation of the magnesium will impair its brilliancy.

18. Two flashlights used together at different points give much better lighting than only one, and should always be used where possible.

19. Both magnesium powder and flashlight mixtures are more quickly fired and with a more instantaneous flash if burnt on a train of gun cotton.

20. With the flashlight at a distance of 5 feet from the head of the sitter, use 10 to 15 grains of flash powder ; at a distance of 10 feet, use 30 grains ; at 15 feet, use 70 grains ; and at 20 feet, use 100 grains.

21. When a flash lamp is put away after use it should be emptied and thoroughly cleaned from stray magnesium powder, and it should always be kept free from damp and grease.

22. A long-stemmed clay pipe filled with magnesium powder makes a good flash lamp. A piece of wadding or rag soaked in methylated spirit should be tied round the bowl and ignited. If the magnesium is then blown through the flame a brilliant flash results.

23. Flashlight will not do more than daylight under similar circumstances, but will, if treated in the same way, do nearly as much, and oftentimes do it quicker.

24. A reflector of white paper or calico is necessary for softening the contrast and lighting the shadow side of the face, if only one flashlight is used for a portrait.

25. Flashlight mixtures should not be roughly handled ; they are liable to explode.

26. For portraiture the flashlight is always best diffused through a light screen of muslin.

27. It is not necessary to turn down other lights in a room when taking a flashlight portrait.

28. When conducting flashlight portraiture at home, look out for unexpected reflections from mirrors, pictures, etc.

29. Flash mixtures should be burnt on a tray or tile. If placed on gun cotton the flash will be practically instantaneous.

30. An electric fan is a useful accessory for the flashlight photographer. It assists in clearing the smoke very effectively.

31. In addition to the flashlight, no extra apparatus is required by the flashlight photographer if portraiture is attempted.

32. A sliding music stand with an improvised flat top or a tall pair of steps can be recommended as useful for placing the flashlight sufficiently high.

33. Given the necessary means for producing an adequate light, the best principles for good studio lighting are also the best that can be studied for flashlight work.

34. To succeed with imitation firelight studies, a sheet of glass or wet muslin should be placed inside the fireplace, to prevent the smoke blowing out into the room.

35. When photographing a large interior by flashlight spread the light, or lights, over as large an area as possible, but have a principal light to dominate the general effect.

36. A reliable flashlight mixture for simple ignition on a train of gun cotton—not for use in a lamp—is made by carefully mixing mangesium powder, 3 parts ; chlorate of potash, 6 parts ; sulphide of antimony, 1 part.

37. Magnesium powder, 60 grains ; chlorate of potash, 90 grains, is a good flash mixture for ordinary work. It must not be used in a lamp, and must be dried separately and carefully mixed with a feather or piece of stiff paper.

38. When focussing a group by flashlight the position of the members of the group and the details of their faces can be more easily ascertained on the focussing screen by each one holding a lighted match or taper near the face.

39. Flashlight silhouettes can be easily obtained by stretching a white sheet across an open doorway, posing the sitter in profile on the same side as the camera, then turn down all lights and ignite flash on the other side of the sheet.

40. When taking a dark interior by flashlight, measure the distance from the camera to the principal object and obtain correct focus with the camera in daylight of another object at the same distance. Then return the camera to the dark interior for use.

CHAPTER X.

Telephotography for Amateurs.

By CAPT. OWEN WHEELER, F.R.P.S.

CAPT. OWEN WHEELER, F.R.P.S.

If you take an ordinary photographic lens and place behind it, at a suitable separation, a negative lens (*i.e.*, one which diminishes objects viewed through it), you produce—assuming that the negative lens is of less focal length than the ordinary or "positive" lens—a sort of photographic telescope. In other words, you enable the image of an object, which the ordinary photographic lens renders quite small, to be magnified, the degree of enlargement depending upon (1) the relation of the focal length of the negative lens to the focal length of the positive lens, (2) the separation between the positive and negative elements, and (3) the camera extension. That, in a nutshell, is Telephotography and the optical combination produced in this way is a telephoto lens.

As regards (1) it is sufficient here to say that, theoretically, you can combine any negative lens with any positive lens so long as the latter has a greater focal length than the former. The greater the disparity the greater the "power" or degree of magnification with a certain camera extension. Thus, if we have a 6-in. positive, and a 12-in. camera extension, we get a higher magnification with a 3-in. negative than with a 4-in.

The separation between the two elements (2) is a subject which even the beginner should take pains to master. For telephotographic purposes it lies between two extremes, one being the focal length of the positive, the other the difference of the focal lengths of the positive

FOLKESTONE HARBOUR.

From two negatives taken from the same spot without moving the camera.
By Captain Owen Wheeler, F.R.P.S.

and negative. If we have a 6-in. positive and a 2-in. negative the separation—measured from the nodes of the two elements—will vary between a fraction less than 6 in. and a fraction more than 6 in.—2 in. = 4 in. If it is 6 in. there is no magnification ; if it is 4 in. the combination ceases to be a telephoto lens and becomes an ordinary telescope. Between the two extremes the magnification increases as the separation decreases, until theoretically the degree of enlargement is infinite. The range of separation, it will be observed, is equal to the focal length of the negative lens, and that portion of the separation which is in excess of the focal lengths of the two elements is called Δ, or the "optical interval." At any given magnification, then, the actual separation with the object at infinity is the difference between the focal lengths of the two elements $+ \Delta$, and in some commercial combinations this fact is applied to the engraving of the mount with a view to reckoning the number of magnifications from the separation. But, personally, I dislike this method, as in the higher magnifications it is apt to be misleading, while it also takes no account of the frequent use of the telephoto lens for near objects, when the separation of the elements for a given camera extension has to be increased, just as in ordinary photography an increase in similar circumstances is necessary between the lens and the focussing screen or plate.

Turning to the camera extension (3), this, in the case of any given combination, must be increased simultaneously with any decrease of the separation of the two elements, in other words, with any increase of magnification. This increase of extension is governed solely by the focal length of the negative element in use. The rule is that E (the camera extension, measuring from the node of the negative lens to the focussing screen or plate) = f/2 (the focal length of the negative lens) × [M (the magnification)—1]. Conversely, of course, $M = \frac{E}{f_2} + 1$. Thus, if we want to obtain with any positive and a 2-in. negative 4 magnifications (*i.e.*, a magnification of 4 diameters), we shall require a clear camera extension of 2 in. × (4—1) = 6 in. Conversely, if we have an extension of 6 in. the magnification, when a 2-in. negative lens is in use, is (whatever the focal length of the positive may be) $\frac{6 \text{ in.}}{2 \text{ in.}} + 1 = 4$.

In the above calculations we completely disregard the positive lens, but both the focal length and the aperture of this element have to be considered in estimating the focal length and the aperture of

any telephoto combination. For all practical purposes it is sufficient, when we know the magnification at which we are working (which, as noted above, can always be determined by dividing the distance between the negative lens and focussing screen by the focal length of the negative lens and adding 1 to the result), to reckon the focal length of the telephoto system as equal to the focal length of the positive multiplied by the number of magnifications. Similarly, the aperture of any telephoto combination is, approximately, the aperture to which the positive is stopped, multiplied by the number of magnifications.

I will now try to illustrate the greater part of the principles laid down above by a single graphic example. You have, let us suppose, a 6-in. ordinary photographic lens and 2-in. "tele-negative" combined in a "tele-mount," "tube," or "setting," with a rack and pinion or other adjustment enabling the two elements to be suitably separated. You screw the whole telephoto lens into the front of your camera and rack out the latter until the tele-negative is 12 in. from the focussing screen. You then rack, or slide, or lever out the tele-mount, tube, or setting until a separation is reached which gives a sharp rendering of the centre of the object on the screen. Finally you stop the positive down to *f*/11. The result will be an image seven times as large [(12 in. ÷ 2 in.) + 1] as that given by the positive lens alone; the focal length of the telephoto system will be 42 in. (6 in. × 7); and the aperture of the telephoto system will be *f*/77 (*f*/11 × 7).

LIMITATIONS.

When the facts comprised in the foregoing simple statement have been grasped the practice of telephotography presents very few real difficulties. Those which are most liable to occur are chiefly connected with illusions which amateurs sometimes persist in cherishing in spite of their almost obvious absurdity. You would be surprised if you knew how often I have to rub it into apparently intelligent people that the telephoto lens is an instrument with limitations, and that it is altogether unreasonable to expect that by spending four or five pounds on a tele-attachment you can readily produce results in every way equal to those which ordinarily would only be possible with a battery of lenses, the cost of which would soon run into three figures.

The three principal limitations to which I think the attention of amateurs should be specially drawn concern (1) speed, (2) definition,

and (3) the circle of illumination or covering power. Before we go any further it is necessary to point out that in mentioning these limitations I am not alluding to the increasingly popular class of "fixed" telephoto lenses, of which the Busch "Bis-Telar," the Dallmeyer "Large Adon," the "Ross Telecentric," and the Zeiss "Magnar" (the alphabetical order in this case removes every vestige of partiality !) are the outstanding examples. These are all true telephoto lenses, but each is adjusted to one unalterable focal length, the magnification being so small that a large aperture is retained, while the corrections are such that good, in some cases excellent, definition is secured without stopping down. Finally, the circle of illumination is in all cases adequate to the requirements which it is professed to meet. I need say little about these lenses here because they are normally used precisely as ordinary photographic lenses are, with the difference that with a short camera extension they give a relatively increased focal length. For portraiture and hand-camera work they are invaluable, and when a lens of this type is used, as in the N. & S. Reflex, interchangeably in the same shutter with an ordinary lens, a notable degree of convenience and efficiency is attained. Personally, I have found all the "fixed" lenses I have tried improved, as regards the brilliance of the results, by the addition of a longish hood, but, owing to the lowness of the magnification and the careful construction of the mounts, this precaution cannot be regarded as indispensable, and in a hand camera the extra projection is sometimes a nuisance.

Reverting to the aforesaid limitations, which have been so successfully removed in the case of "fixed" telephoto lenses, the matter of speed can readily be explained by what was said a little while back as to the aperture of telephoto systems. If the latter is the aperture to which the positive or ordinary lens is stopped multiplied by the magnifications, the "power" must necessarily be low in order to obtain anything like instantaneous results even in a good light. As a matter of fact, in summer and at the seaside, it is often possible to get very decent telephoto snap-shots, even with an ordinary positive stopped down a little, at four or five magnifications. But it is well for the beginner to realize at the outset that the telephoto lens, unless of the special "fixed" type, is essentially a slow lens, indeed a very slow one when a fairly high magnification is desired, and the necessary stopping-down has been effected.

As regards definition, again, the ordinary multi-focal telephoto

combination formed by putting together an everyday photographic objective and a tele-negative lens in a mount or setting is apt to be disappointing to those who expect too much, as the ordinary amateur almost habitually does. It is all very well to say, "I have got a 'positive' lens which I know to be of superlative quality, and I propose to procure a tele-negative which I am assured is as well corrected as it is possible for such a lens to be. Surely, the combination *must* be all right, and, if it isn't, then telephotography must be a queer sort of fraud." Alas! it sometimes happens that positive and negative lenses actually by the *same* first-class maker do not give good definition over the whole of a plate, even with considerable stopping down. There are two explanations. First, all telephoto lenses necessarily work best at one particular magnification and consequent aperture, and those may not be the magnification and aperture at which you want to work. This is not, as a rule, a serious difficulty, as the majority of tele-negatives on the market are admirable compromises, working satisfactorily over a considerable range of magnifications. But there are also positive lenses which, while working superbly alone, seem liable to undue disturbance of some of their corrections when combined with negative lenses, unless the latter have been specially computed for use with them. I shall have something more to say on this point a little later, when I come to the question of choosing an outfit.

The third limitation noted above, that connected with the circle of illumination, is one of material importance where low magnifications are concerned. The simplest formula for ascertaining the circle of illumination given, irrespective of aperture, by a telephoto lens is stated below. C is the diameter of the circle, f1 the focal length of the positive, f2 the focal length of the negative, M the magnification, and d2 the diameter of the negative lens.

$$C = (M-1)\frac{f1 \times d2}{f1 - f2}$$

Thus if the magnification is 6 times, the focal length of the positive 6 in., the focal length of the negative 2 in. and the diameter of the negative 1 in., the diameter of the circle of illumination will be

$$(6-1)\frac{6 \times 1}{6-2} = 7\tfrac{1}{2} \text{ in.}$$

If you look into the above formula you will readily perceive that it is only possible to cover a fair-sized plate at low magnifications

if your negative lens is one of comparatively large diameter. In the best tele-negatives the diameter is about half the focal length. If you have a 6-in. positive and want to cover a 5×4 plate satisfactorily at 3 magnifications, you will find it necessary to use a 3-in. negative. But if you only have this one negative lens your range of magnifications will be small unless your camera extension is inordinately long. For at 10 magnifications a 3-in. negative demands a camera extension of 3 in. ×(10—1)=27 in. If, then, you have only one negative lens and a restricted camera extension you must be content with a certain number of magnifications, very few if you want to be able to work at ×3, and more if you are content with anything over, say, ×6.

TELEPHOTO REQUISITES.

Before taking up telephotography—unless he is prepared to procure an entirely new and specially selected kit, the amateur will do well to make sure that his existing apparatus fulfils certain necessary conditions. In the first place, the lens which he is going to use as a tele-positive must be a really good one, preferably a high-class anastigmat working at not less than *f*/6·8. It should be fitted with at least one orthochromatic screen which should be a true "optical flat," and it will be found a great convenience to have two such screens, one from ×4 to ×6, the other from ×10 to ×15. The camera must be one which is really firm at full extension, and it is imperative that it should have a thoroughly rigid front. There is no better camera for telephotography than the Sinclair "Una," because it has practically the rigidity of a "square-form" without being anything like so cumbrous, while the extension is quite adequate for any but extraordinary purposes. Messrs. Sinclair and Co. make a special "Una" with triple extension, but I prefer the ordinary pattern myself, especially in the 5×4 size, which I regard as ideal for all-round tourist telephotography. The full extension in this case is about 12 in., with which, by using a $1\frac{1}{8}$ in. negative lens, nearly 11 magnifications can be obtained after allowing for the projection of the tele-lens inside the camera. If the would-be telephotographer's camera is a "Una" the focussing screen is sure to be of very finely ground glass, but, if the grain be at all coarse, the screen should be changed for a micro-grain one. Frequently, too, it is advisable to procure a fresh stand for telephoto work, as one which does very well for ordinary photography may be quite useless when the camera is fully extended with a rather heavy

tele-lens and a long hood projecting from it. Personally, I use my 5×4 Una on a stand intended for a 10×8 camera, and often, in addition, employ an auxiliary unipede lens support. Again, some operators carry only the flimsiest and "skimpiest" of focussing cloths for ordinary stand work. For telephotography one of good size and complete opacity is desirable.

Let us now take the essential *new* requirements, the tele-mount or setting, the tele-negative or negatives, the tele-hood, and the focussing magnifier. As regards the first, little need be said, as all makers of tele-negatives also supply mounts or settings, and as a general rule the beginner will procure his first tele-attachment—as the combined negative lens and mount are called—of one make. But care should be taken to let the first negative lens procured be of the greatest focal length which it is intended to employ, because if this is done shorter-focus negatives can be adapted to the same mount by having them mounted with extension pieces, whereas the converse is not always practicable.

Reverting to what I said on page 70 as to the importance of getting negatives which work well with existing positives, I regret that in only one case do I know of a series of up-to-date tele-negatives which have been expressly computed to work with a given series of ordinary or positive lenses. There may be several others, but I personally do not know of any negative lenses but those of Ross—in whose business I am sorry to say I have not a particle of interest—which entirely fulfil this condition. The Ross negative lenses, I happen to know, are specially made to work with the Homocentric, and, if you have one of the latter working at *f*/5·6 or *f*/6·3—I cannot speak with certainty about the *f*/4·5 series—you may procure Ross negatives for it in perfect confidence that the results, through a long range of magnifications, will be as good as it is practically possible for them to be. In many cases a Ross negative works extremely well with positives of other makes, and frequently other positives and other negatives work together as well, to all intents and purposes, as if they were specially made for one another. But, unless they have been so made, there is no absolute certainty, even when the names on both positives and negatives are of the highest repute. If, then, your positive does not happen to be a Homocentric, you must, in purchasing a tele-negative, to some extent take your chance unless the maker of the lens you have will guarantee to provide you with a negative or negatives giving at reasonable magnifications as

compared with focal length really good definition all over the plate at, say, *f*/11. More than this it is hardly fair to stipulate for.

If you can only afford one tele-negative, the best ratio of focal length to the focal length of the positive is, I think, as 1 : 3. For a 6-in. positive a 2¼-in. negative is very suitable, and with a 5×4 Una this will give a range of magnifications, with the plate covered, from ×4 to rather over ×6. By adapting a 1¾ in. negative to the same mount over 7 magnifications can be obtained at full extension, and with a 1⅛ in. negative nearly 11 magnifications.

A tele-hood is of serious importance, as without it the tele-lens is liable to internal reflections which seriously impair the brilliance of the image. Messrs. Sinclair & Co. have a very sound and efficacious arrangement consisting of two of their rectangular lens-hoods joined together, but personally I confess to a preference for telescoping tubes of aluminium, the smallest tube lined with dead-black cloth, paper or Atkinson's special "optical black."

Of focussing magnifiers there are several excellent commercial varieties, among which the beginner can choose for himself, giving preference to a pattern of fairly high power.

GETTING TO WORK.

A good way for a beginner is to make a general practice of focussing any object which he intends to telephotograph first with his ordinary lens. This will enable him to get a fair idea of the degree of magnification which will be necessary in order to get a satisfactorily enlarged image. If he is working with a 5×4 camera, and the object as rendered on the screen with a 6-in. lens is 1 in. long by ⅘-in. high, it is obvious that at 5 magnifications it will fill the plate, and that probably 4 magnifications at most will be required. Having in this way obtained a pointer to the "power" which will give the desired result, and decided that, say, 4 magnifications will do what is wanted, the procedure may be as follows. Unscrew the ordinary lens and screw it into the front end of the tele-mount or setting, at the rear end of which you have already screwed in the tele-negative—which we will assume in this instance to be of 2¼-in. focus—with the plane side outwards, *i.e.*, so that it will come nearest to the plate. Fasten on the tele-hood, but do not at present fully extend it, and then screw the whole tele-lens into the camera front. If necessary adjust the unipede lens support, but not rigidly, in case the camera may have to be tilted.

Now multiply 2¼ in. (the focal length of your negative lens) by the magnifications less 1 (4—1 = 3) and this gives you your camera extension, namely, 6¾ in. Rack out your camera until there is approximately this distance between the negative lens and the focussing screen. For the present do not touch the camera further, but get your object in focus by adjusting the rack and pinion or other movement on the tele-mount. If the picture does not appear to be the right size you must alter the camera extension, racking in to get a smaller and out to get a larger magnification, and subsequently refocussing by altering the separation of the positive and negative elements, that is, by working the rack and pinion, or slide, or lever of the tele-mount as before. But remember that, if you alter the extension, you also alter the magnification and, if you have done this appreciably, you will have to allow for it later in calculating the exposure. But we will take it that you have got the size of the picture right, and in that case all you have to do is to focus forthwith very sharply with the rack and pinion or other adjustment and the focussing magnifier. Do not attempt to get the final focus by altering the camera extension. In order to get good definition throughout stopping down to *f*/11 or *f*/16 may be necessary. While focussing extend the tele-hood as far as you can without cutting off any of the picture, and, if you are using an orthochromatic screen, focus with it in position. Remember that with many lenses you cannot safely focus at full aperture and then stop down. Personally, I habitually focus finally at the aperture at which I am going to work. If the magnification is high, or the light bad, a little lanoline smeared on the focussing screen is a great help.

In my own practice I seldom work at any but fixed extensions, and I advise all who possess two or three tele-negatives of varying foci to do the same. With, say, three tele-negatives of 2¼ in., 1½ in. and 1⅛ in. focus respectively, adapted to a tele-setting for use with a 6-in. positive and a 5×4 "Una," a little table can easily be made, showing exactly what each will do at the single or double extensions of the camera, and it only remains to set up the latter at one or other extension and use the tele-negative which gives the required "power."

EXPOSURE.

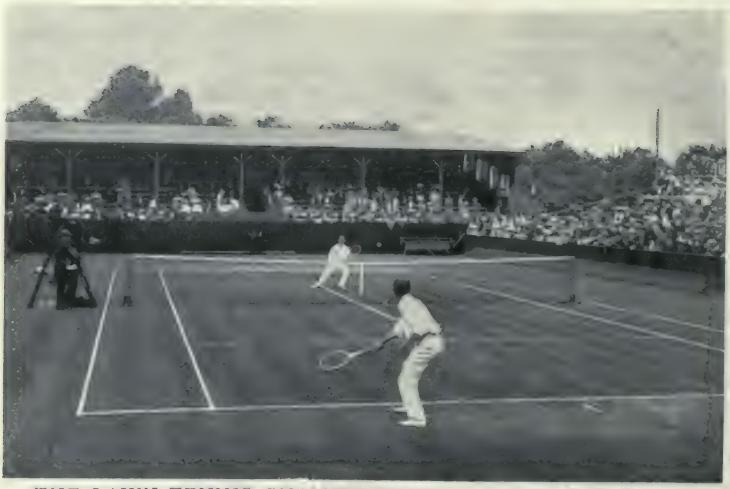
And now for a few words as to the chief difficulty in telephotography, namely, the exposure. I am far from saying that this is not a real difficulty, and I do not mind confessing that I sometimes go

rather badly astray myself, but in such cases I generally find that through pre-occupation I have missed some condition which should have been fairly obvious. The accepted rule is to multiply the exposure which would be required if the positive or ordinary lens were used alone by the square of the magnifications, and I believe that, in the case of a near object which does not alter in character by being telephotographed, this rule is absolutely correct. This last sentence sounds a little cryptic, perhaps, but is easily explained. You have, let us suppose, an open landscape with a light foreground and a building in the distance. This is a subject which with an ordinary lens in a decent light would require a very short exposure indeed. But, if you telephotograph the building at, say, 10 magnifications, it may fill the plate and so become, from the exposure-meter point of view, quite another sort of subject, and you must make allowances accordingly. Then again, you have to consider the distance, especially if it is the least bit hazy. In such cases extreme allowance has to be made, and you will often find that a quarter of the exposure as ordinarily calculated will be sufficient. You will comprehend the reason for this when you reflect that in taking a similar view with an ordinary lens you would probably over-expose the distance at least four times for the sake of the foreground.

As a rule it is better not to use the shutter release for telephoto exposures, as even the slightest vibration tells. A deep cap is usually preferable.

DEVELOPMENT, ETC.

No special instructions are needed under this head. But in case of under-exposure perhaps a little more assistance can be gained from the use of the Uranium Intensifier than in ordinary work. In some cases in my experience the improvement has been very remarkable.



THE LAWN TENNIS CHAMPIONSHIP. *Dr. C. D. Somers.*

JUMPING DOGS. *Jno. R. Keeble, Esq.*

These prints show what can be done with actual speed of $\frac{1}{100}$ second. The upper one was taken with the N.S. Reflex, the lower with the Sinclair "Una."

CHAPTER XI.

The Art of Intensifying and Reducing Negatives.

J. McINTOSH, F.R.P.S.
By W. Watmough.

By J. McINTOSH, F.R.P.S.,
Secretary of the Royal Photographic Society.

In applying methods of intensification and reduction, it is necessary for complete success that the photographer should have not only a knowledge of what these processes will accomplish but also a thorough understanding of the faults that are to be remedied and the process of discriminating between the remedial processes. The experienced photographer knows at least the defects of his negatives, even if he has not practised the arts of correcting them, but the photographer who has only recently taken to the camera has naturally everything to learn. It will be assumed in what follows that the reader is in the position of one asking for information on all points.

The faults in negatives which are curable by intensification or reduction are due to incorrect exposure or incorrect development and very likely to both. Those due to the second cause are much more easily dealt with than those resulting from the first, and the inexperienced photographer is advised to spare no pains in acquiring the power of judging the correct exposure under all conditions. The actinometers now sold for this purpose simplify the matter to such an extent that comparatively little is left to the judgment of

the worker. The cost of an actinometer, the time spent in understanding it and the cost of a box or two of plates expended in experimental work will be speedily recouped in the improved quality of the negatives and in the saving of labour that would otherwise have to be expended in correcting faults. Intensification and reduction should be regarded as processes to be applied as seldom as possible, as the need for them is, as a rule, due to errors on the part of the worker.

A plate may be correctly exposed, over-exposed or under-exposed. A correctly exposed plate may be correctly developed, or it may be over-developed or under-developed. An incorrectly exposed plate will never make a perfect negative under any conditions, but it may be lightly developed or fully developed. As the inexperienced worker may have some difficulty in classifying his faulty negatives it is desirable to indicate the appearance of the prints which can be obtained from them before remedial measures are adopted, and to specify the simplest remedies to which resort should be had. It should be understood that no one process of intensification or of reduction is the best under all circumstances and at the risk of imparting uncalled-for information it may be pointed out that intensification increases the density of a negative, that is, it makes it stronger, while reduction lessens the density.

We may take first the case of a plate which has been correctly exposed. If the developer is one which has been correctly compounded the image will appear in from 20 to 45 seconds. The high-lights will first show as black patches, the half-tones will gradually appear, then the details in the shadow portions and finally the whole surface, with the exception of the margins, will darken over. If at this stage the negative is rinsed and washed it will be perfect of its kind, but if development is carried too far the negative will become so dense that even in bright light printing may occupy several hours, and it will be found that before the details of the high-lights are visible in the print, the shadows will be heavy masses of ungraduated black.

Obviously it is necessary to get rid of the excess of density, and in doing so the high-lights and shadows should be reduced proportionately. This does not mean that the density is to be reduced equally over the surface of the plate, since in that case the shadows would lose more in proportion than the high-lights. The only agent which will do what is required is ammonium persulphate. Only a

sufficient quantity of the salt for the work in hand should be taken, distilled water should, if possible, be used and a fresh portion of the solution should be employed for each negative. The formula is :—

Ammonium persulphate	8 grains.
Sulphuric acid (10% solution)	20 minims.
Distilled water	1 ounce.

Another dish containing a five per cent. solution of sodium sulphite should be at hand and an unused fixing bath of ordinary strength is also required. The negative is immersed in the persulphate solution, care being taken to flood it all over, and it must be closely watched. The persulphate solution is somewhat capricious in its action, but as a rule it works very slowly at first, increasing in speed as the action progresses, so that once reduction of density is seen to be taking place a close watch must be kept lest the action should proceed too far and the image be entirely obliterated. When the density is judged to be sufficiently reduced the negative is to be at once, and without washing, transferred to the sodium sulphite solution for five minutes. It must then be well washed, placed in the hypo bath for a few minutes, thoroughly washed and dried. The sodium sulphite checks the action of the persulphate at once and the hypo bath removes any salts which may have formed in the gelatine, but a thorough washing is required before the negative is placed in the fixing bath, since, if any acid remained in the film, the hypo would be decomposed and the negative be stained a deep yellow with probably considerable danger to its permanence.

In the second place we may take the case of a correctly exposed negative, but with which the development has been checked before the whole surface of the plate has darkened over. A print made from such a negative on one of the printing-out silver papers, if examined soon after printing has begun, will appear as a very delicate image, correct in gradation, but much too weak to stand toning and fixing. As printing proceeds the image will darken all over and it will be impossible to have pure whites. In this case it is necessary to strengthen the image proportionately throughout, that is, greater strength must be added to the high-lights than to the shadows. Undoubtedly the best method is that advocated by Mr. Chapman Jones and the formula is as follows :—

Mercuric chloride	1 ounce.
Distilled water	16 ounces.
Hydrochloric acid	32 minims.

The negative is immersed in this till it is bleached white when examined from both sides and is then washed in several changes of water, acidulated with hydrochloric acid, say 40 minims to the pint. It should then be washed in a dozen changes of plain water when it is ready for the next operation, which is to blacken the bleached image. The formula is :—

Saturated solution of potassium oxalate	6 parts.
Saturated solution of ferrous sulphate	1 part.

The ferrous sulphate solution should be poured slowly into the potassium oxalate solution, otherwise a yellow precipitate is formed. The negative is immersed in this until the image is thoroughly blackened when it should be well washed before drying.

If the increase in density is not sufficient the operations may be repeated as often as required, but many workers find that they cannot repeat the operations successfully, though this is entirely due to want of chemical cleanliness. Those who prefer to obtain considerable access of density by one operation may employ the following method, but the results cannot be guaranteed to be permanent. The negative is bleached and washed as in the previous method and is then blackened in a 1 in 20 solution of ammonia, after which a very thorough washing should be given before drying.

In the third place we may take the case of a negative which has been over-exposed. When the developer is poured over it the image will appear quickly, and before the high-lights have time to gain density the half-tones and shadows will also appear and in a few seconds the whole surface will darken over. If development is carried out very fully the negative will be dense, it will take a long time to print and the picture will be flat, showing but slight contrast between the lights and shadows. In such a case the density requires to be reduced more in proportion in the shadows than in the high-lights. No chemical is known that will reduce the strength of the shadows without at the same time removing some portion of the density of the high-lights, but there is a whole host of chemicals which will reduce the density equally over the whole surface of the plate. In doing so it is obvious that the proportion removed from the shadows is greater than that from the high-lights and the desired object is attained. A simple and satisfactory reducer of this nature is :—

Potassium permanganate	4 grains.
Sulphuric acid	8 minims.
Water	5 ounces.

In this the negative is immersed till the required reduction takes place, when it should be well washed and fixed in a freshly-made hypo bath of ordinary strength. If after the permanganate bath the negative is found to be stained brown or yellow, the cause is an insufficiency of acid in the bath. The stain may be removed before fixation by immersing the negative in :—

Sodium sulphite	60 grains.
Oxalic acid	12 grains.
Water	1 ounce.

The negative must be thoroughly washed after this bath and fixed in hypo as previously stated.

In the fourth place we may take the case of an over-exposed plate which has been removed from the developer before great density has been obtained. A print from such a negative will show little contrast at any stage of printing and as printing is continued, will quickly darken all over. The remedy is to increase the density of the high-lights without adding to the density of the shadows. This is quite possible, but requires some judgment in checking the action at the required stage. The image is first bleached in a mercuric solution and is then blackened in a solution of silver cyanide. This latter solution at first converts the image of white silver and mercurous chloride to the metallic state and then dissolves out the mercury. The action commences on the surface of the film and proceeds slowly downward. The result is that as the shadow detail lies on the surface it is first strengthened and then reduced to its original strength. A proportion of the half-tones and high-lights are also on the surface, but also go deeper into the film. The result of careful treatment is that by checking the action at the right time the increase of density in the lights and half-tones is only partially undone and a considerable accession of contrast is obtained. This process of intensification is known as Monckhoven's and the working details are as follows. Three solutions have to be made up, they all keep well and they may be used several times until exhausted.

No. 1.

Mercuric chloride	100 grains.
Potassium bromide	100 ,,
Water (distilled)	10 ,,

In this the negative is bleached and is then thoroughly washed as in previously described methods. It is then blackened in a solution made by combining the two following :—

No. 2.

Silver nitrate	100 grains.
Water (distilled)	10 ounces.

No. 3.

Potassium cyanide	100 grains.
Water (distilled)	1 ounce.

No. 3 is added gradually and with constant stirring to No. 2. At first a heavy white precipitate is formed, which is dissolved on the addition of the cyanide solution. Care should be taken not to add more than is sufficient to dissolve the precipitate, otherwise the blackening of the image will not take place satisfactorily. The solution should be poured into a dish and if running water is not at hand a large bowl or pail of water should be near by. The negative is immersed in the silver cyanide solution and at once the surface of the negative will blacken. After one or two seconds the plate should be lifted out and the back of it examined. In all probability the shadows only will be blackened, the lights and lighter half-tones remaining white. It is to be returned to the bath and again examined. Presently the half-tones will blacken and then the high-lights. Immediately the last trace of white has disappeared from the back of the negative the plate must be held under running water or plunged into the pail of water to check the action of the silver cyanide solution. Thorough washing should follow, and it will be found that the contrast in the negative has been greatly increased.

We now come to the case of under-exposed negatives, and it must be understood that comparatively little can be done in such cases and only if the error in exposure has been slight. Nothing but the pencil can supply missing shadow detail. An under-exposed plate will develop slowly, the half-tone and shadow detail lagging long after the appearance of the lights. Many workers in such a case push development to the farthest in the hope of getting printing density. It is, however, a bad practice. If the subject is one with much contrast, the high-lights will be extremely dense, whilst the shadows will still be very thin and fog is almost certain to still further disfigure the negative. The print will show violent contrasts, the shadows being masses of solid black and the high-lights being simply spots of white paper. Negatives of this description may be improved (if not too bad) by the following method, but it is one that requires considerable judgment in applying it.

The following solution is made—

Chromic acid	30 grains.
Potassium bromide	60 „
Water	10 ounces.

In this the negative is thoroughly bleached and is washed in water till the deep yellow colour which it takes is discharged. One or two baths of a five per cent. solution of potassium metabisulphite will assist in getting rid of the colour. During these operations the negative should be well exposed to white light. The negative has then to be redeveloped, and a clean working developer should be selected. Metol, metol-quinone, ortol and glycin are all suitable. The object is to get rid of a portion of the density in the high-lights, which can be done in the following manner. When the developer is poured upon the plate the whole of the surface is converted once again to black metallic silver ; the action, however, proceeds slowly and may be examined from the back of the plate in the same way as in Monckhoven's intensification process. The shadows and the upper surface of the half-tones and high-lights are first converted to black metallic silver, whilst the lower portions of these two latter, being more deeply imbedded in the gelatine, take longer to develop. When from examination at the back of the plate it is seen that all but the highest points of light are redeveloped, the plate, without intermediate washing, is plunged into a freshly-made fixing bath, which removes the silver bromide left in the film and the lights are reduced in density.

If the action of the developer is carried too far, the contrasts will be just as violent as in the beginning ; if on the other hand it is checked too soon, the negative will be flat and thin. It is better to err on the latter side than on the former, as the error may be remedied by intensification, as in the case of an under-exposed, lightly-developed negative, to be considered next, while, although the operations just described may be repeated, irregularities of action are almost certain to ensue. Grease on the surface of the negative will also cause much trouble.

An under-exposed negative which contains no strong contrasts, may be developed very fully without harm ensuing, if only fog, whether due to the developer or the light of the dark-room lamp, is avoided, but in all cases it is safer to develop lightly and trust to intensification for improvement. Such a negative, if strong contrasts are present, will show the details in the high-lights clearly,

but the shadows and half-tones will be uniformly grey. The object must be to strengthen the half-tone and shadow as much as possible while adding as little as may be to the lights. There are many intensifiers which will do this, but the simplest is the uranium intensifier, which has the further advantage that those who are skilful in the use of the brush may remove it entirely from the high-lights. The following solution is to be made up—

Uranium nitrate	4 grains.
Potassium ferricyanide	4 „
Acetic acid	1 drachm.
Water	1 ounce.

In this the negative is immersed till the surface becomes a warm brown colour. If the action is carried too far, the whole of the image will change to a brick-red colour, and the effect will be to accentuate the contrasts. If, however, the action is checked before the half-tones and lights are completely affected, the greatest possible addition will have been made to the strength of the shadow detail, and whilst fair printing density will have been attained, the contrasts will not have been increased. The negative should then be rinsed in water, slightly acidulated with acetic acid, till the yellow colour in the unexposed margins is discharged. Prolonged washing will result in the whole or the greater part of the intensification being removed. If, when the negative is dry, it is found that the contrasts are still too strong the intensification may be removed from the high-lights by the application to these parts of a 1 in 20 solution of ammonia by a camel-hair brush. The surplus liquid should at once be taken up with a bit of blotting paper to prevent it from spreading to parts where it is not required.

Many other intensifiers and reducers can be employed, but the object has been to avoid confusion by giving one only for each purpose and to select those which are simple in their application. Most of the chemicals are of a poisonous nature and can only be sold by a chemist to whom the purchaser is personally known, and in consequence cannot be obtained from the ordinary photographic dealer. Much may be done by the pencil and stump to improve the quality of faulty negatives, high-lights may be rubbed down with methylated spirit applied with a piece of chamois leather, and for the same purpose, Basket's reducer, made by mixing globe polish, olive oil and terebene may be employed in a similar way. *Papier minéra* may also be stretched while damp over the back of the negative, and

when dry the portions over the high-lights may be cut away with a sharp knife. All these methods, however, are somewhat outside the scope of the present article.

In conclusion, one word of advice is offered. All negatives, and especially those which have to receive chemical treatment, should be thoroughly fixed and thoroughly washed. The latter point is so frequently referred to that its value may be supposed to be well understood, but thorough fixation is of even greater importance and when the photographer has reason to suppose that intensification or reduction may be nccessary, he will do well to employ two fixing baths, allowing the negative to remain the same time in each, which he is accustomed in the ordinary way to give to the single bath.

J. McINTOSH.

"HOMEWARDS." *J. A. Sinclair*

Taken with the Sinclair "Una" Camera held in the hand.

CHAPTER XII.

Printing on P.O. Paper.

THE P.O.P. PROCESS.

Probably at some period of the photographer's career, he or she passes through the P.O.P. stage. "P.O.P." means in short "Printing-Out Paper," and were the initials used by the Ilford Company to describe this process when they placed upon the market a gelatino-chloride paper, at the same price as the albumen papers, which up till that time had been generally used. P.O.P., as commercially known, consists of paper coated with a mixture of silver salts and gelatine, and the great bulk of it is made with a glossy surface. It has excellent keeping qualities, providing it is kept in a cool, dry place. The paper may be purchased in sheets, but the amateur will doubtless prefer the packets cut to the size required for his negatives. Care should be taken not to touch the surface with moist fingers, for any mark made would result in a defect in the finished print.

PREPARING THE PRINTING FRAME.

For those who have not done any photographic work previously a word about printing frames is desirable. Purchase a simple form of frame with the back hinged two-thirds of the way along, so that when examining the print the bulk of the picture may be seen by unfastening one of the springs which hold it in position. The springs should be preferably hinged to lift up, and not turn sideways, for such sideways motion will often move the back and the sensitive paper beneath it. The corners of the frame should be screwed, and if glued, see that none of the glue has formed into ridges along the edge where the negative or glass rests, or a broken plate may be the result. It is a great safeguard if a piece of clean glass of good quality is used as a support for the negative. The back of the frame being removed the negative is placed in it, glass side downwards, and a piece of the P.O.P. laid on it, then a rubber sheet or felt pad, to ensure perfect contact, and afterwards the back of the

frame held by the spring fastenings. Printing from thin negatives may be done in weak light or from dense ones in sunlight, the prints being examined from time to time by weak diffused light to see what progress is being made. Printing should be carried considerably further than desired in the finished print, and the exact amount will be learnt after one or two trials. The printing being finished, if not convenient to tone at once the prints may be transferred back to the original packet and kept for a considerable time.

PRINTING.

Before toning, the prints must be washed, and this apparently simple operation should be done with method and care. Use plenty of water, and if running water is not available transfer the prints one by one to a large dish of water, keeping them moving the whole of the time. The silver salts will commence to dissolve out of the prints, making the water milky, and immediately this occurs transfer them to another dish of clean water. These operations should be conducted by artificial light or very weak daylight. When the washing water remains quite clear the prints are ready for toning and the bath is simply compounded as follows :—

WASHING.

TONING.

Ammonium sulphocyanide ..	30 grains.
Water	20 ounces.
Gold chloride	2 grains.

Gold chloride is sold in 15-grain tubes. Buy the best quality (Johnson's). Break the tube by hitting it when between a sheet of notepaper, and dissolve in 15 drams of water. Then each dram contains one grain of gold chloride and it is easily measured. Dissolve the sulphocyanide and then add the gold solution, do not mix them in the reverse order. The bath may be used at once, but is better if mixed twenty-four hours before use. It should not be less than 60°F.

Use a large dish for toning and plenty of solution. Immerse the prints one by one, seeing that they are perfectly covered and that air-bells do not form on the surface. Keep them moving during the whole time of toning and the colour will gradually change, till finally they are almost blue. For a good purple photographic tone watch till the surface begins to look somewhat blue and no red is apparent when the print is viewed by transmitted light. On the

surface the print may appear somewhat overtoned. Then rapidly rinse the prints in several changes of water and transfer to a somewhat weak fixing bath.

FIXING.

The fixing bath is as follows :—

Hypo	2 ounces.
Water	20 ,,

Keep the prints moving in this solution for ten or fifteen minutes and transfer to running water for thirty minutes.

The prints are dried by placing them face upwards on clean blotting paper or suspending them by clips from a line.

SQUEEGEEING.

If it is desired to get a fine and even enamelled surface the prints are squeegeed on to plate glass or some other glossy surface. This may be done after washing, but to ensure their leaving the surface to which they have been squeegeed, it is desirable to dry them first and then immerse in water again till limp before squeegeeing and in hot or moist climates to alum them in addition. To alum the prints insert them in a solution of

Alum	1 ounce.
Water	20 ounces.

for ten minutes, then wash for ten minutes and squeegee them face downwards on to the pulp, or celluloid slab, or plate glass. Pulp slabs and celluloid sheets, sold specially for this purpose, require no special preparation, but plate glass, which gives the finest results, should be first very carefully cleansed with a solution of hot washing soda, and after drying, dusted all over with French chalk rubbed on with a clean flannelette duster. All surplus chalk being removed, the prints are taken from the water and laid face downwards on the glass. A piece of rubber sheeting, or even a sheet of paper, is placed on top and a flat squeegee is drawn first down the middle and then gradually worked to either side so that all superfluous water is freed from under the print.

The sheet of glass is then stood in a dry place where there is a good current of air and when the prints are bone dry they may be easily removed if they do not drop off without assistance. Don't try to remove them till they are absolutely dry or they will be cracked and the surface spoilt. In the winter drying is accelerated by placing the squeegee slab over a kitchen range or mantelpiece.

BACKING THE PRINT.

If it is desired to mount the print with any ordinary mountant and at the same time conserve the high gloss, the print must be backed. While it is yet on the squeegee slab and about half dry, a piece of cartridge paper, fractionally smaller, is pasted and squeegeed in contact with the print. This dries with it and makes it thick enough to stand a thick mountant without the surface being affected.

DEFECTS AND THEIR CAUSES.

Unevenness of Colour is caused by allowing the prints to stick together in the toning bath. They must be kept moving.

Red Patches that refuse to tone are usually caused by touching the surface of the paper with warm and damp fingers.

P.O.P. COMBINED TONING AND FIXING BATH.

The combined bath is simple and the present results are as fine, or finer, than when using separate baths. The fault has been impermanency. Mr. A. C. E. Stanley, in *Photography*, suggests the following as a reliable and rapid combined bath :—

Make four solutions as follows :—

A.	Hypo	4 ounces.
	Water	20 ounces.
	Ammonia ·880	15 minims.
B.	Ammonium sulphocyanide	1 ounce.
	Water to	10 ounces.
C.	Lead acetate	1 ounce.
	Water to	10 ounces.
D.	Gold chloride	15 grains.
	Water to	15 drams.

The quantity of the bath is governed by the number of the prints to tone and fix. For twelve quarter-plates (or six half-plates or three whole-plates) make the bath as follows :—

4 ounces	A.

and add in order—

2 drams	B.
1 dram	C.
36 minims	D.

The prints must be kept rapidly moving and removed when the colour desired is obtained.

CHAPTER XIII.

Bromide Printing and Developing.

J. STERRY, F.R.P.S.

By J. STERRY,

Honorary Fellow of the Royal Photographic Society.

As the first catalogue of Bromide Papers, taken at random, gives eighteen varieties from which to make a choice, the beginner may need some help in his first selection. There need not be much trouble, however, as all may be readily classified thus :—

TABLE I.

SURFACE.—Glossy, Smooth, Rough, Matte.
COLOUR.—White, Mauve, Pink, Tinted.
RAPIDITY.—Rapid, Slow, Very Slow.
GRADATION.—Long, Medium, Short.

It will be seen that the most important differences are in the rapidity and gradation, whilst surface and colour may be looked upon as varieties only, which later on will be selected specially to suit the subject in hand.

RAPIDITY.

But little, also, need be said respecting rapidity, as that simply governs the relative duration of the exposure with any given negative, whilst, of course, in the case of rapid papers greater care must be taken to prevent the action of stray light during the different processes. The various uses for different rapidities may be classified thus :—

TABLE II.

RAPID.—For enlarging by artificial light and the contact printing of dense negatives.

SLOW.—For enlarging by daylight or contact printing of negatives of medium density.

VERY SLOW.—(Gaslight papers) are specially suited to the contact printing of negatives which are very thin and weak.

The rapid and slow require the use of a dark-room, but a bright orange light is all that is needed for safety in working. The gaslight papers have the further advantage of being readily worked in a room lighted by gas.

GRADATION.

It is here that the greatest difference in the character of various papers will be found, and for want of a knowledge of which the beginner often meets with failure in his bromide printing. Not being able to attribute his troubles to the real cause, he is unable to determine as to whether it is his own fault in working or the unsuitability of the paper to the negative from which he wishes to print.

But very little information is given by the makers upon this point, notwithstanding its great importance, therefore, before dealing with practical working, it will be well to try and make it as clear as possible. When once thoroughly understood and working upon the lines to be laid down, it will be quite easy to determine what can and what cannot be done with any given paper or negative.

Gradation may be described as the range of the paper, or its power to represent varied degrees or proportions of light action.

The shortest gradation or range found in any paper is about 1 to 16, that is, if an exposure of one second to the chosen source of light at a specified distance just gives the faintest possible trace of action upon the paper, when fully developed, then about sixteen seconds at the same distance would be found to give the deepest black obtainable.

On the other hand, a very long range paper would probably be found to require over one hundred times as much exposure to obtain the deepest shade as would be needed just to impress it at all, the development being in this case also carried as far as possible.

Seeing that any negative selected for trial must transmit a definite scale of light intensities according to the density of the silver

deposits, it is clear that the same result could not possibly be obtained on both papers (short and long range) if the development were carried out to the full.

Now, whilst it is true that stopping the development before it is quite completed does somewhat alter the scale, the control thus obtained is so slight, that the better plan is to ignore it altogether and start with the general rule, *that development shall be carried to the full.* Any slight disadvantage due to this determination is amply compensated for in the certainty of being able to duplicate results, and also in the ease and speed of working generally. (Later on, a slight chemical modification in the development will be described which gives a real change in the gradation of the paper at will).

THE NEGATIVE.

The object of this paper is to give the best plan of working for a difficult subject, requiring the fullest range of white to black that can be obtained, such as a landscape with bright clouds and deep shadows. More easy subjects not using the full scale of light will not receive special consideration, upon the principle that "the greater includes the less." Very poor results are often seen in bromide prints because so many think that any negative and any paper should somehow be made to work together, which is very far from being the case.

From what has been said about gradation it is evident that there must be some particular character in the negative which will make it suitable for printing with each of the papers. This difference is found to be solely connected with the development of the plate, and has nothing whatever to do with the exposure in the camera. Given correct exposure, then the relative duration of development solely determines the printing character of the negative and its suitability for obtaining the best results by different printing processes.

For bromide printing generally, and especially for enlarging, the negative requires *less development* than for any other printing process.

The following table will give a general idea of the differences needed in the development of the negative to make it best suited to the different papers.

TABLE III.

Development of the Negative.	Character of the Negative.	Paper for Contact Printing.	Paper for Enlarging.
Very short.	Very thin.	Gaslight paper.	Slow bromide.
Short.	Thin.	Slow bromide.	Rapid bromide.
Medium.	Medium contrasts.	Rapid bromide.	Rapid brom. and special treatment.
Long.	Strong do.	Do. and special treatment.	Do.

Unless one is specially preparing negatives for bromide printing, it is better generally to develop, so that they will be of use for another process such as platinum printing, and then to classify them according to the table above. It will then be possible to select the most suitable paper or mode of working.

EXPOSURE IN PRINTING.

As it has been shown that with a given negative there is one kind of paper which (say, for contact printing) will give the best results with full development, it is easy to see that the exposure must be such that the most dense part of the negative shall be represented in the finished print by white paper or a faint tint.

It is here that the advantage comes in of not allowing any variation in the time of development, but always carrying it to the full, because it is vastly more easy to arrive at the correct result when only one condition of working (exposure) is varied at once.

Make this, then, the starting point in every trial—*Find the exposure that will just give upon full development the faintest detail desired in the most dense part of the negative.* The manner in which the shadows are then found to have been rendered will at once show how far the paper chosen has been correct or otherwise.

If the shadows are not deep enough the paper is too rapid, because, generally speaking, the more rapid the paper the longer the gradation. If there is not all the detail shown in the shadows which it is thought the negative should render, then the paper used has been too slow. If, however, the most rapid paper has already been used in making the trial, then the special treatment to be described later will probably prove useful.

Naturally one would not make use of any extra treatment unless compelled to do so, both on account of the extra trouble, small as

it may be, and also because the result probably would not be quite equal to that which could be obtained from the paper which was in itself most suited to the negative.

As it is very desirable to be able to record exposures so that they can readily be repeated at any time, a systematic method should be arranged from the outset. The following will be found useful for all varieties of contact printing.

SOURCE OF LIGHT.

Bromide Papers.	Lamp or gas (No. 5 Bray Flat Flame).
Gaslight Papers.	Gas (No. 5 Bray or incandescent), or magnesium ribbon.

Some plan should be arranged for making exposures at definite distances from the source of light, so that the correct amount may be given in, say, 10 or 20 seconds. A useful scale may be arranged by marking off distances as shown below upon a board about 4 feet in length.

If the source of light is placed at A, and the distance of one metre or one yard is taken as the unit, then the value of the light will be as shown by the numbers, if the distances are marked off thus :

DISTANCES IN INCHES.

Unit ..	1	1½	2	3	4	6	8	12	16	24
Metre ..	39·37	32·2	27·8	22·7	19·7	16·1	13·9	11·35	9·85	8·05
Yard ..	36		29·4	25·4	20·7	18	14·7	12·7	10·4	9	7·35

EXPOSURE SCALE.

If it were then found that a certain negative and paper required 20 seconds' exposure to the Bray gas, when placed at 1 (metre), the needed information could be registered as 20 G.M.S. (20, gas, metre, seconds). When using a slow bromide paper, if it were found that 120 seconds should be given at point 1, then the entry would be made 120 G.M.S., though to save time in printing the actual exposure might be 15 sec. at point 8 giving the same result. In the same way when using a gaslight paper, M. (minutes) would have to be substituted for seconds, or the required length of magnesium ribbon and distance noted. (One inch of magnesium ribbon ⅛-in. wide is about equal to a No. 5 Bray burner at one metre, burning for 10 minutes).

THE DEVELOPER.

BROMIDE PAPERS.—Almost any developer may be used, but one of the most satisfactory is amidol. A stock solution of sodium sulphite is made of about 10 grains to the ounce of water, and a little time before required, 1 grain of amidol is added to each ounce of solution. The amidol need not be weighed each time, but may be measured with sufficient accuracy with a small spoon or on the point of a knife.

N.B.—The sulphite should not be kept more than a few days, as it deteriorates. No bromide of potassium should be needed to prevent fog, so that this developer is very simple and it gives the finest blacks.

Notwithstanding the fact that several prints may be developed in succession in the same developer, it is a rather doubtful policy, as the action soon slows down and there is a tendency to discoloration as the developer becomes weakened.

The time taken to obtain full development will vary with the speed of the paper, the general rule being that the more rapid the paper the slower will be the development. Three or four minutes will probably be sufficient for the one that develops most slowly.

GASLIGHT PAPERS.—These differ from the ordinary bromide papers, and always require some bromide of potassium in the developer. The metol-quinol developer has taken the first place, and full directions are given in the packets. When used of full strength the developer may be applied with a brush, the print to be developed being placed on the back of a dish. The image flashes up almost instantly, and development is completed in less than half a minute.

It is very important that no more bromide of potassium be added to the developer than is absolutely necessary, otherwise the tone of the black will be affected.

We will now consider the practical working. In the first instance three papers will be sufficient, and these will readily give all the necessary general knowledge of the process of bromide printing.

1. Rapid White, Smooth Bromide Paper.
2. Slow do. do. do.
3. Matte White Gaslight Paper.

We will presume that ¼-plate negatives are to be used, and the paper obtained of that size. Prepare, say, ½ oz. of sulphite of soda dissolved in 20 ozs. water. Amidol for the bromide paper.

M.Q. cartridges for the gaslight paper and 1 per cent. bromide of potassium.

Now select a negative (preferably a landscape with well-defined clouds and somewhat heavy shadows in the deepest parts) which as nearly as possible answers to what is considered the meaning of a *thin* negative (Table 3), taking care that it has had sufficient exposure to be full of detail.

Examine it carefully in a good light, and notice the most dense portions that show some sign of detail. If any cloud is shown in any part of the sky then take that portion for the purpose of obtaining the correct exposure as described below. If there is not any cloud, then notice particularly any portion of the distance which is but little less dense than the sky.

The object is to find as previously noticed, some portion of the picture which *should be just represented in the print by a very faint tint*, and then to find the amount of exposure to the light that will just give this result upon full development. This is the exact opposite of the good old rule in negative making, "Expose for the shadows and let the high-lights take care of themselves." That which cannot be done in the negative is possible in bromide printing, so that the rule may stand. Expose for the high-lights, and if the shadows don't come right of themselves, a slight extra treatment will probably bring them right.

We will presume that the source of light chosen is a No. 5 Bray gas burner, and having in the dark-room placed, say, one quarter of a sheet of slow bromide paper upon the selected portion of the negative in an ordinary printing frame, we will give a trial exposure of 20 seconds at the point 4 on the scale, equal to 80 seconds at 1 on the metre scale. If the area of the trial portion will permit of being divided up, time will be saved by obtaining three exposures on the same piece of paper, thus :—Cover the front of the frame with a card, and when the frame is in position before the burner, uncover one-third of the paper for 20 seconds, then another third for 10 seconds, and remove the card altogether for 10 seconds more. The exposures will then have been 40, 20 and 10 seconds respectively, equal to 160, 80 and 40 G.M.S. at point 1. If, after full development, by which is meant that fresh detail no longer continues to appear, the desired exposure is not found within this scale, but evidently greater or less, a guide will have been obtained for a second trial.

We will suppose that the portion that has had 20 seconds appears a little too dark, and that with 10 seconds does not show at all, but is quite white ; then it is evident that an exposure of about 15 seconds or 60 G.M.S. should give at any rate this one portion of the picture as desired.

We may now proceed to make a full-sized print from the negative, and see what knowledge can be gained from the result obtained.

There is one thing that should be constantly borne in mind—the finished dry print is always less brilliant than when wet, so that the exact final appearance cannot be ascertained until it is dry. After a few trials it will be comparatively easy to estimate this difference and to learn when a wet print is satisfactory.

Having, then, obtained a print exposed 15 seconds at 4, developed, fixed, washed and dried as directed in the instructions with the paper, we shall find that the high-lights are very closely correct, but the shadows *may not* be satisfactory. In any case whatever, the following table will be found to cover all points and show both cause of difference and remedy.

TABLE 4.

Result.	*Cause.*	*Remedy.*
1. Very black shadows. Too brilliant result.	Negative too much developed for the paper used ; gradation of paper insufficient.	Try again with more rapid paper (if rapid paper had been used the modified treatment to be described would be required).
2. Shadows good.	Correct.	Correct.
3. Insufficient depth in shadows, flat result.	Negative not sufficiently developed for the paper used, gradation of paper too great.	Try again with a slower paper.

It will be noticed that no such table as this could be made unless full development were the rule in working, and the remedy might not then be easily found because of the complication of causes of error.

As it will now perhaps be necessary to try working with the gaslight paper, the only points to be observed are :—

1. The usual dark-room is not needed, but it may be lighted with an ordinary gas burner.

2. A developer containing bromide of potassium must be used, as described in the directions.

3. The exposure may be to the gaslight as before, but requires so much time that it is more readily made by burning magnesium ribbon. One inch lighted at the distance marked 8 on the scale would probably be suitable for a first trial. The rest of the work will follow in the same manner as described for bromide paper.

EXTENSION OF THE GRADATION.

It only now remains to describe the method of using the modification in development, which will extend the scale of gradation.

So far nothing is known that will *decrease* gradation in the development of bromide papers, except the addition of bromide of potassium in large quantities, which at the same time very materially alters the colour of the deposit and is occasionally employed for that purpose ; consequently, if a negative is so thin that it will not give a good *black* print on gaslight paper, the only remedy is to deal with the negative itself and intensify by means of one of the well-known processes. Hitherto the greatest difficulty in bromide printing has been to obtain good prints from negatives which, having been developed to give considerable contrasts as required for P.O.P., platinum, etc., are too hard for representation by means of the most rapid papers, notwithstanding that they have a long scale of gradation. This difficulty is more especially found in enlarging, because the negative is needed to be so much thinner then than for contact printing.

Experiments upon the action of bichromate of potassium (and other salts) upon the latent image or its development (*Photo. Journal*, Feb., 1904) showed that by means of weak solutions applied for a short time between exposure and development the scale could be greatly lengthened out, thus extending the detail in the shadows without materially altering the result already obtained in the high-lights or changing the colour. The result is, therefore, that whilst the speed of the paper remains practically unaltered, so far as it affects the rendering of the high-lights, and the exposure required is therefore the same, a print on gaslight paper can be made to give a similar result to that obtained upon slow or rapid bromide paper, or even if desired, a longer gradation than either.

Consequently good prints can be obtained upon gaslight papers from almost any negative, except, perhaps, some that have been

developed excessively. These may be dealt with by extending the scale of the rapid bromide paper in the same manner.

The method is exceedingly simple, for nothing else is required but the addition of a very small quantity of bichromate of potassium to the washing water before development. The alteration made is dependent upon the strength and time of immersion. The action is so rapid that it is well to keep to one length of time, say, 1 minute, and vary the strength only. Exposure will be the same, but development should be continued until the desired strength of the picture is obtained. The high-lights soon cease to increase much in depth, but the shadows gradually put on strength like the development of a negative plate. This process may be described as the flattening of too great contrasts, and, of course, if overdone will result in too flat a print just as in the case when in the ordinary way the negative is too thin for the paper (Table 4,3). A full description, with examples of the effect obtained were given in *Photography*, Jan. 30th, 1904, p. 94.

So far, only one make of paper has been found practically unaffected by bichromate of potassium, but, speaking generally, the slower the paper the less strength required to bring about a change.

For gaslight papers 1 part of bichromate of potassium in 500 water will be found to have a very marked effect, and 1 part in 100 will be sufficient for trial upon the bromide papers.

The best way to commence is to take a negative which gives a print, say, upon gaslight paper, in which, when the high-lights are correct, the shadows are black and without detail (Table 4, 1).

Having exposed a piece of the paper under this negative for the proper time for the high-lights, cut it into four strips. Immerse one strip in a bichromate of potassium solution, 1 to 500, for one minute, rinse in changes of water for 15 or 20 seconds altogether, and develop with one of the other pieces. If the difference is not sufficient take another of the strips and place in the same way in the 1 to 100 bichromate of potassium and develop. If the action is now too great and the print too flat altogether, another trial can be made with the fourth strip. When a very great alteration is desired, it may be found necessary somewhat to increase the exposure, because there is a tendency after a time when strong bichromate of potassium is used to practically destroy the weak portions of the image.

An acid fixing bath should be used, as any stain remaining from the bichromate of potassium is removed during the fixing.

The same course is to be carried out when the gradation of the slow and rapid bromide papers is to be extended. Should an excessive alteration be desired, it is most readily accomplished by substituting permanganate of potash, about 1 part in 1000 water, for the bichromate. A deep brown stain may be left on the paper, but this is cleared away in the acid fixing bath.

ENLARGING.

The methods previously described are readily applied to enlarging.

The trial exposure must be made upon a portion of paper placed in position upon the easel, the highest lights being as before selected for trial.

It is a peculiarity of enlarging that the negative behaves, when compared with contact printing, as though it had been developed much longer, consequently a longer scale of the paper is required to give good results. Even with the most rapid paper and the longest scale obtainable, most negatives will be found too strong to give the best possible results, and the bichromate method will then be found particularly useful. After exposure simply follow the directions previously given under contact printing.

GENERAL REMARKS.

If before taking up general printing, four negatives are selected (or, better still, purposely prepared by exposing four plates equally on the same subject and developing for *varied times*) as stated in Table 3, and experiments made so as to obtain both good contact prints and enlargements, using the three papers selected and the control with the bichromate of potassium, the set will be of great service. It will make a standard with which to compare other negatives, and by means of which it will not be difficult to select by inspection the best method of working. The bromide print is probably the most lasting of all silver printing processes, and the ease with which it is produced without recourse to daylight makes it specially suited to the requirements of the amateur.

From being the most exacting of all processes as regards the negative, the method of control of gradation described, adapts it to both weak and dense negatives, whether used for contact printing or enlarging.

J. STERRY.

HAPPY HOURS.
Taken with the N.S. Reflex by Mrs. Churchill Still.

THE YOUNG OPTICIAN.
Taken with the N.S. Reflex by James A. Sinclair.

CHAPTER XIV.

Platinotype.

Although the process of printing in platinum is one of the most beautiful that can be imagined, and has the advantage of absolute permanency, yet it is not used to the extent that might reasonably be supposed. It is the simplest, quickest and easiest printing process, providing one has a good negative, but a good negative is essential. Unfortunately, the bulk of negatives taken on films are thin and under-exposed and, as such, are useless for platinotype. When we have a good, well-developed and clean negative then no process is so satisfactory as platinotype, for no paper where salts of silver are used will give such rich blacks as are obtained with metallic platinum.

Platinotype paper is sold in hermetically sealed tins and the contents of these tins when they are opened should at once be transferred to a storage tin or tube sold specially for the purpose. These storage tins contain a supply of chloride of calcium, a salt which absorbs moisture from the atmosphere and keeps the paper in good condition. The chloride of calcium should be occasionally examined, and if found in the slightest degree soft or moist, replace it by a dry supply. It may be dried by heating in a shovel till red hot and replaced in the tin immediately it is cool.

To secure the most brilliant results the sensitized paper *before*, *during* and *after* its exposure to light must be kept as dry as possible.

Care should, therefore, be taken to see that the negatives are "bone dry," and after placing in the printing frame with the yellow or sensitive side of the platinotype paper in contact with the film, a quite dry pad of rubber sheeting should cover the paper, then a felt pad and afterwards the back of the printing frame. The Platinotype Company point out in their instructions :—

The effect of damp is seen in a want of vigour, a general muddiness of tone, and, where the sensitized paper has been exposed to its influence for some days, in the impaired purity of the whites.

The paper should never be torn, as there is risk of particles of platinum falling on the paper and causing black spots on the print.

The "black" papers keep in good order for a considerable time if kept in a cool dry place in proper calcium tubes or the unopened patent tins in which the paper is supplied.

EXPOSURE TO LIGHT.

The correct exposure (about one-third of that required with silver printing) is ascertained by inspection of the paper in a rather weak white light in the usual manner. A little experience will enable the exposure to be determined very accurately; but, generally speaking, we may say that the printing should be till the detail in the high-lights is just faintly visible.

When examining the prints in the printing frames, care should be taken not to expose them unduly to light; for the degradation of the whites of the paper due to *slight* action of light is *not visible until after development.*

Damp paper gives a less visible image than dry paper, hence it may easily be over-exposed.

Remove the prints to a calcium tube as soon as exposure is complete, unless they are to be at once developed.

DEVELOPMENT.

Development should be conducted in a feeble white light, similar to that used when cutting up the paper, or by gaslight.

It may take place immediately after the print is exposed, or at the end of the day's printing.

The developer will keep indefinitely when made of full strength, but requires to be diluted by at least an equal quantity of water before use. When diluted the developer does not keep so well, and therefore it is advisable only to dilute the quantity actually required.

The formula we recommend for rich black tones is :—

A. D. Solution. Contents of Platinotype Co.'s tube of D salts, dissolved in 48 ounces of water .. .. 1 part.

Water (distilled or well boiled) .. .. .. 1 ,,

N.B.—The D salts or developing salts, are the special salts recommended by the company for development, and are sold in ½-lb. tubes.

The whole contents of the tube must be dissolved at one time, as the salts are mixed; for, if this is not done, too large a proportion of one of the ingredients may be used.

An Alternative Solution.—If the D salts cannot be obtained, the following developer may be used :—

B. Oxalate of potash solution, normal strength (*i.e.*, 1 lb. oxalate dissolved in 54 oz. water) .. .. 1 part.
Water .. .. 2 parts.

A saturated solution of oxalic acid may be added in proportion of 1 part to 20 parts of mixed developer.

In cases where prints appear granular, or where intense blacks are wanted, use the following formula :—

C. D solution as above .. .. 2 parts.
Water .. .. 1 part.

Full development is essential, and at 60°F. thirty seconds should be allowed. Less is required at higher temperatures.

A gives slightly more half-tone than B.

B gives slightly warmer tones than A.

C is advisable when prints appear granular, or where intense blacks are wanted.

Develop by floating the print, exposed side downwards, on one of the above solutions A, B or C. In cases where workers find a difficulty in doing this, the print may be immersed face up and *immediately* turned over. With rough papers such as C.C. and R.S. immersion is almost compulsory if air bells are to be avoided. The object in turning face downwards is to prevent particles of platinum, which sometimes become disengaged from the surface of the print, settling on the surface and producing black spots and comet-like marks.

Development may take thirty seconds or more : *a correctly exposed print cannot be over-developed.*

Solutions must never be less than 60°F. and 70°F. is recommended.

REMARKS.

1st.—If the print is too light after development it shows that the exposure has been insufficient.

2nd.—The developers, in consequence of their dilution, will deteriorate after a certain number of prints have been developed on them. If defective development be observed, replace the worn-out bath by a new solution from the stock bath. Keep the used solutions separate from the stock.

3rd.—Warmer tones are given by the B bath if it be made slightly alkaline. If made acid this bath will give colder tones than if neutral.

Alkali should on no account be added in larger quantity than is just sufficient to blue red litmus paper. Ammonia is unsuitable ; potash, soda or the carbonates of these alkalis may be used.

4th.—As scum is apt to form on the surface of the solution, it is well to skim it with a stiff piece of paper to remove the scum, in order to avoid developing marks on the print.

Always rock the bath or stir the solution between each development ; this will break up any scum which may be left by the previous print.

5th.—The developers may be warmed. At a temperature of about 100°Fah. under-exposed prints may often be saved. It is usual for a warm developer to give rather warmer tones. It is not advisable to use a bath of a lower temperature than 60°Fah., or brown and muddy tones may result.

6th.—The sensitive papers generally improve in condition by being kept a few weeks after manufacture. They remain in good condition for a considerable time if kept in a cool, dry place, in the special storage tubes.

The bottom of the developing dish should be covered with the developing solution to the depth of *at least* one-half of an inch.

After the prints have been developed put the solution, without filtering, into a bottle for future use ; it should not be exposed to a strong light. When next developing the solution will be found to be *nearly clear, but, of course, tinted by previous use.* If this clear solution be not sufficient for use, add to it some fresh developing solution. It is a safe plan always *to keep the "bath-solution" up to its original bulk* by this means. A little suspended matter in the bath is not of any consequence.

With weak negatives the addition of a little bichromate of potash to the bath gives brighter prints. The amount necessary depends upon the degree of "cutting-out" required, the strength of the developer, and particularly its temperature. The stronger the developer and the higher the temperature the more bichromate is necessary. At 160 degrees Fah. the salt has little or no effect. One grain of the solid to every 10 ozs. of a cold developer makes a distinct difference. The de-oxidizing action of the salt present in such minute quantities, gradually wears off, which may be compensated by the very cautious addition of fresh bichromate.

CLEARING AND WASHING.

To clear the developed prints : these must be washed in a series of baths (not less than three) of a weak solution of hydrochloric acid. This solution is made by mixing 1 part of hydrochloric acid with 60 parts of water. The specific gravity of the acid should be not less than 1·16 ; if lower, more acid should be used. The acid should be colourless. On no account should commercial hydrochloric or muriatic acid be used. Citric acid, in proportion of 1 ounce to 20 ounces of water may be used. This softens the paper in less degree than does the hydrochloric acid. *A white opalescence of the bath shows necessity for more acid.*

As soon as the print has been removed from the developing dish it must be *immersed face downwards* in the first bath of this acid, contained in a porcelain dish, in which it should remain about five minutes ; meanwhile, other prints follow as they are developed. The prints must then be removed to a second acid bath for about ten minutes ; afterwards to a third bath for about fifteen minutes. While the prints remain in these acid baths they should be moved so that the solution has free access to their surfaces, but care should be taken not to abrade them by undue friction. It is impossible to affect the image *per se* by leaving the prints for a long time in the acid bath ; but such treatment, continued for an hour or more, tends to make the paper soft and porous, and to damage the surface of the paper.

The prints should not communicate to the *last* acid bath the slightest tinge of colour. If the bath, after the prints have been washed in it, does not remain as *colourless as water* when a depth of fully two inches is viewed in *full daylight*, the prints should be treated to yet another acid bath.

Pure hydrochloric acid *must be used.*

If commercial or muriatic acid be used, the prints will be discoloured and turn yellow.

For each batch of prints fresh acid baths must be used.

After the prints have passed through the acid-baths, they should be well washed in three changes of water during about a quarter-of-an-hour. It is advisable to add a pinch of washing soda to the second washing water to neutralize any acid remaining in the print. Do not use water that contains iron, as it tends to turn paper yellow. Soft water is the best for this purpose.

MOUNTING.

Use a mountant which does not stain or show through the print. Gelatine alone is not suitable, except for thick paper. Thick cold starch is a good mountant or the adhesive dry mounting process will be found very satisfactory.

INSTRUCTIONS FOR THE USE OF THE SEPIA PAPER.

With few exceptions the method of carrying out the operations is the same as for the "black" kinds of platinotype paper. The *following points* should be attended to :—

The "Sepia" paper is more easily affected by faint light, and, therefore, increased care must be taken when printing.

The following developer, specially prepared by the Company, is particularly recommended :—

½ lb. sepia developing salts dissolved in 32 ozs. of hot water (distilled or rain water).

Temperature of developer, about 170° Fah. This developer is complete in itself and requires no addition.

For those who are unable to obtain the sepia developing salts, the following developer is recommended :—

Ordinary oxalate developer, normal strength (1 lb. oxalate dissolved in 54 oz. of water)	10 parts.
Saturated solution of oxalic acid	1 part.

The solution must be heated to a temperature of 160° to 170° Fah. to obtain the greatest amount of brilliance and the warmest colour, but very good results can be obtained by using a cool developer.

The development is effected by *floating the printed surface* of the paper for five or six seconds upon the "developing solution." To avoid air bubbles : lay one edge of the print upon the solution near the right-hand end of the dish ; then, with a sliding motion towards the left, lower the print, with an even movement, without stoppage, until it is entirely in contact with the liquid, where it must remain until *complete* action has taken place.

The solution is conveniently contained in a flat-bottomed dish of enamelled iron, heated by a small Fletcher gas stove. If no gas is obtainable, a spirit-lamp may be used for the smallest dish, or for the larger dishes a paraffin-stove.

Granitine dishes may also be used, and if ordinary care is taken will stand the heat without cracking.

It is advisable to put a thin piece of tin between the flame and the dish, to spread the heat.

As, owing to the temperature of the bath, evaporation takes place, it is necessary to add, from time to time, sufficient *water* to bring the bath nearly up to its original bulk. The developer obviously cannot be kept fully up to bulk by this means, as each print uses up a certain amount. Fresh solution must be added from time to time to make good such waste.

Greater care must be used with sepia than with black paper to avoid exposure to light, both when examining the prints and even in the first acid bath, otherwise the whites will be discoloured.

Discoloration of the whites is due to one of the following causes : 1. Too much exposure of the developing solution to light ; 2. Use of an iron dish in which the enamel is cracked so as to expose the iron ; 3. Paper kept too long ; 4. Exposure of prints to too much light while clearing.

The developing bath after use *must be kept in the dark.* This bath must not be used for " black " prints.

The prints are cleared in an acid bath of 1 part hydrochloric acid (s.g. 1·16) to 60 parts of water.

As the " Sepia " prints, unlike the " black " ones, may be affected by light *when in the acid bath,* the lights being stained and degraded, the prints at this stage must be manipulated in a *very weak* light. The prints are damaged by being left long in the acid baths.

The subsequent operations are the same as for the other kind of paper.

Granitine baths or dishes, carefully heated, are the best to use for a sepia developer.

An enamelled iron dish which has been once used in developing sepia prints, should on no account be afterwards used in developing black-toned prints, or the purity of the blacks will be destroyed.

Black and sepia prints should never be cleared or washed together in the same dish, for the reason given in the preceding paragraph, nor should black and sepia papers be stored together.

THE " JAPINE " PLATINOTYPE PAPERS.

These papers are made in two grades, black and sepia.

The " Black Japine " is developed in exactly the same way as

the other black platinotype papers, with the exception that the floating on the developer may be prolonged for one or two minutes, development being much slower.

For the " Sepia Japine " the development is as follows :—

DEVELOPMENT.

The special " Sepia Japine " developer is recommended, as undoubtedly giving the best results.

Dissolve the whole contents of the tube of special " Japine " developing salts in 32 ozs. of hot water (rain or distilled). When the salts are dissolved allow the solution to cool, then add 10 ozs. pure glycerine (which must be free from acid). The whole must be thoroughly mixed and strained through muslin.

The developing solution must not be exposed to strong daylight ; if this precaution is taken it will keep indefinitely. Use plenty of developer to avoid scraping prints on bottom of dish.

This developer is used without dilution, at a temperature of 100° to 120° Fah., or it may be used cool. In most cases the results obtained by the higher temperature will probably be preferred. The cold developer should not be allowed to drop below 80° Fah.

The exposed prints are wholly immersed in the developer. From two to four minutes should be allowed for full development, according to temperature. Several prints may be developed together, gently turning them over a few times to ensure equal action. The developer may also be applied with a brush.

N.B.—Full development is essential in order to obtain the richest tones.

Alternative Formula.—Platinotype sepia salts—½ lb. packet dissolved in 32 ozs. of hot distilled or rain water. Working temperature 160° Fahr. This developer gives rather warmer tones than the special " Japine " developer, with less depth of colour in the shadows. The use of enamelled iron dishes is not recommended. Granitine dishes can be employed with safety.

CLEARING.

The print, after removal from the developer, is immediately placed in—

Pure hydrochloric acid	1 part.
Water	60 parts.

Three baths are necessary, the times of immersion being respectively five, ten and fifteen minutes. The prints should not communicate to the last acid bath the slightest tinge of colour. If this does not remain as colourless as water, when a depth of at least two inches is viewed in full daylight, the prints should be treated to yet another acid bath. Pure acid *must* be used.

WASHING.

Four or five changes of water for about twenty minutes will be sufficient.

GLYCERINE BATH.

After washing, immerse prints for about ten minutes in—

Glycerine	1 part.
Water	20 parts.

This solution can be used repeatedly.

DRYING AND MOUNTING.

The prints are conveniently dried between clean blotting paper, without pressure.

Any good tenacious mountant may be employed in the usual way, but the recently introduced dry-mounting method will be found the most satisfactory.

IVORY BLACK PLATINOTYPE.

The instructions for this new paper, which is made in two grades, smooth and rough, and which gives a brown-black image on a toned ground, is the same as for the Sepia papers save, that the Sepia salts are diluted with 80 ounces of water and the temperature should be 120° F. The results are almost like a photogravure.

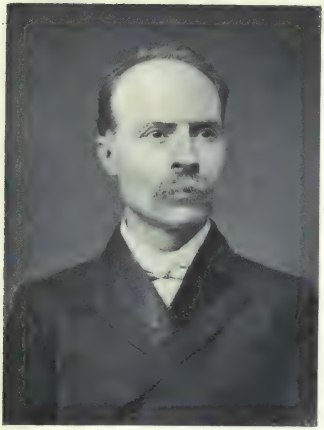
E. G. Becher, Esq.

THE GORGE OF THE ZAMBESI.

Taken with the Sinclair "Una" Camera.

CHAPTER XV

Carbon Printing.



HENRY W. BENNETT, F.R.P.S.

By HENRY W. BENNETT, F.R.P.S.

Although it cannot be claimed that the carbon process is the most simple of photographic printing methods, it presents no special difficulty. If the work is undertaken in a systematic manner success is certain. The process is essentially different from all others, both in principle and in working. In commencing, new methods have to be encountered; but it is novelty that presents itself, not difficulty.

The following notes have been written as an introduction to carbon printing for those who know nothing of the process. Everything essential is given so that successful results may be obtained from first essays. But no attempt has been made to give any other than the simple instructions necessary for preliminary work. The many variations possible would require more space than can well be given here.

The beauty and distinctive quality of carbon prints are too well-known to require description. These characteristic qualities induce most artistic workers to adopt carbon as their favourite medium; and its flexibility or adaptability to varied tastes and requirements in the hands of those who have become familiar with its working, is an inducement for selecting it in preference to processes that are not capable of so much variation.

Paper prepared for carbon printing is called carbon tissue. It consists of a stout strong paper carrying a film of coloured gelatine. This film is perfectly soluble, but becomes insoluble on exposure to light. By printing under a negative the degree of insolubility will vary in different parts of the film according to the extent of the action of the light transmitted through the various parts of the negative. After printing, the soluble portions of the film are dissolved away by soaking in hot water, the parts that remain form the picture. The colour of the finished print is determined solely by the pigments mixed with the gelatine when the film is manufactured. In describing the process it sounds clumsy ; in practice it is capable of yielding the finest and most delicate results.

Carbon tissue may be purchased either sensitive or insensitive, and in a variety of colours. Sensitive tissue will only remain in good condition for about ten days ; insensitive will keep indefinitely. Sensitizing is a simple operation, and the most satisfactory method for amateur workers is to keep a stock of insensitive tissue of various colours, and to sensitize to suit the requirements of the moment. The author has introduced an improved sensitizing solution, by means of which tissue may be sensitized so as to give results equal in every respect to that sensitized in course of manufacture.

The formula is :—

Potassium bichromate	4 drams.
Citric acid	1 dram.
Water	25 ounces.
Ammonia .. ..about	3 drams.

The potassium bichromate and citric acid should be dissolved separately in hot water, the solutions mixed, and sufficient ammonia added to change the colour of the solution from orange red to lemon yellow. It is imperative that the ammonia be added immediately after mixing the two solutions. The solution, if mixed as described, will keep indefinitely, and may be used many times in succession for sensitizing. It should be used at a temperature as near 60 degrees as possible.

For sensitizing, sufficient of the solution should be poured into a dish, a piece of tissue immersed and allowed to remain for ninety

seconds. It should then be withdrawn, laid face downwards on a piece of glass or slate, and gently squeegeed so as to remove as much of the sensitizing fluid as possible. It should then be lifted from the glass, pinned to a lath by two corners, and hung up to dry. Drying will require from four to six hours. Sensitizing may be carried out in full daylight, but the drying must take place in a room or cupboard darkened to such an extent as not to affect silver printing-out paper. The most satisfactory method is to sensitize at night and remove the tissue from the drying bath the following morning.

In printing, the dark side of the sensitive tissue must be placed next to the film of the negative. No visible image is produced in printing ; consequently, the time of exposure in the printing frame must be gauged by means of an actinometer. Several types of actinometer may be obtained commercially, the most satisfactory being that which consists of a series of partially transparent numbered squares. These squares vary in density from the lowest to the highest number, so that by exposing a piece of silver printing-out paper to daylight for a short time a faint image of the square bearing the lowest number is produced. Longer exposures will strengthen the image of the first square, and produce faint images of the other squares. The method of using is to place a piece of silver paper in the actinometer and place the instrument at the side of the frame containing the carbon tissue when that is put out to print. When the carbon print is taken in, the actinometer is carefully examined. The highest square that can be seen on the actinometer print is the number that registers the printing of the carbon tissue. If this is found to be correct, future prints from that negative may always be secured with certainty by printing to that number in the actinometer. It is imperative to always use the same brand of silver paper for the actinometer.

Tissue sensitized by the formula given is approximately equal in sensitiveness to Ilford or Imperial P.O.P. A rough print may be taken of a portion of the negative on either of these papers, using the same paper in the actinometer, and noting the actinometer number when the print from the negative is sufficiently dark for the effect wanted and not over-printed as for toning. By printing a piece of carbon tissue to the number thus obtained, it will be found to be correctly exposed.

Many workers may prefer to use ready-sensitized tissue for their

first experiments in carbon printing. This removes one possible source of failure by ensuring perfect material. It should be noted, however, that ready-sensitized tissue is more rapid than that sensitized by the method given. Autotype tissue will require about half the exposure, and Barnet about three-fourths.

Before printing in carbon, the negative must be provided with a "safe-edge." This is an opaque edging to the negative, or, as a substitute, a thin mask may be interposed between the negative and tissue, or attached to the glass side of the negative. Its object is to protect the edges of the carbon tissue from the action of the light; so that the margins of the print are white. Whatever form the safe-edge may take, the tissue should overlap it to the extent of one-eighth of an inch, at least. This is an absolute necessity for successful working.

After printing, the exposed tissue should be stored in a calcium tube, or under pressure until ready for development. A printing frame will answer sufficiently well for a few hours. A piece of transfer paper will be required for each print. Transfer paper may be obtained when the tissue is purchased. Several kinds are prepared commercially, varying in texture and tone from thin smooth and perfectly white to thick rough white and toned drawing papers. The thinner papers will require soaking in cold water for about five minutes before using, the thicker kinds for half an hour. Before putting the pieces in water, it is desirable to mark the back with a pencil.

When the transfer paper has soaked sufficiently, a piece of exposed tissue should be immersed in cold water face downwards, the corresponding piece of transfer paper being immersed in the same dish, under the tissue, and face upwards. As soon as the exposed tissue becomes moderately limp—before it has become sufficiently limp to lie flat in the water—the tissue and transfer paper are withdrawn together, face to face and firmly squeegeed into contact. They are then placed between blotting paper under moderate pressure for twelve to fifteen minutes—not longer. Any number of prints may be partially dried in this manner, at the same time. After fifteen minutes the prints are placed in cold water for five minutes or longer, until required for development. Half an hour's immersion will not hurt them, and it is not desirable for the inexperienced to develop more than one print at a time.

For development the print is placed in moderately hot water. The best temperature is 105 degrees. After a few seconds' immersion colour will be seen oozing from the edges of the print. It will, of course, be recognised that the print is now a film of coloured gelatine imprisoned between two papers, the original paper and the transfer paper. The original paper support should be uppermost when the print is placed in the developing bath. When the colour is seen oozing from the edges, a corner of the original backing paper is gently lifted away from the transfer paper. If it comes away easily it should be steadily pulled entirely off, and thrown away. If it lifts with difficulty, the print should be left for a few seconds and another attempt made from a different corner. Care must be taken to keep the print below the surface of the water during the operation of removing the backing paper. The coloured film will now be left on the transfer paper, and at this stage it presents a most unpromising appearance. It is simply a soft, jelly-like mass of coloured gelatine. By keeping it in the hot water, and gently splashing the water over it for a few minutes, the soft and soluble portions of the film are washed away and the picture remains on the transfer paper. It should be lifted from the water from time to time to drain off the semi-liquid gelatine and colour, so that the progress of development may be seen. As soon as the picture is sufficiently light, it should be rinsed in cold water, and then placed in a solution of alum. A good strength for this solution is one ounce to a pint of water. Prints on thin papers should remain in the alum solution for about five minutes, those on thick papers for ten to fifteen minutes. When taken from the alum bath the prints should be washed in three or four changes of cold water and hung up to dry. On no account should their surface be touched until dry. After drying their surface is comparatively hard ; they may be re-wetted for mounting and touched without injury.

This method of working is called "single transfer," because the film is transferred from the original paper support to the single transfer paper. It possesses the disadvantage of reversing the picture. For many subjects this is unimportant ; for those in which it is inadmissible a second operation is necessary, the re-transferring of the film from the support on which it is developed to a paper which is to be its final support.

For development, a specially prepared paper is used instead of the single transfer paper. It is called "temporary support," and

must be prepared for use by rubbing a little waxing solution* over its surface a few hours before it is required. It may be used for many prints in succession by re-waxing each time. The work of squeegeeing, developing, aluming and drying is performed in exactly the same manner as for single transfer.

After drying, the print on the temporary support and a piece of specially prepared paper called "final support for double transfer," are immersed in cold water for ten or fifteen minutes. They are then placed in hot water—about 100 degrees—for a few seconds, until the surface of the final support is soft and yielding. The two are then withdrawn from the water together, face to face, placed on the squeegeeing board, final support uppermost and firmly squeegeed into contact. When thoroughly dry the final support bearing the image can be easily pulled away from the temporary support.

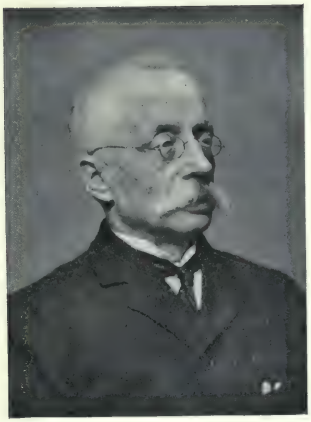
* The waxing solution may be purchased ready for use or may be made as follows :—

Yellow resin	36 grains.
Yellow wax	12 grains.
Turpentine	2 ozs.

Melt the wax, add the resin a little at a time stirring meanwhile, then remove from the fire and add the turpentine.—E. J. WALL.

CHAPTER XVI.

Ozobrome.



THOMAS MANLY, F.R.P.S.

By THOMAS MANLY, F.R.P.S.

Ozobrome is a very easy step from silver printing to carbon printing. An Ozobrome picture is a carbon picture, but it is produced in a much easier and more convenient way. A bromide print is used instead of a negative, and the printing is done, not by the influence of light, but by chemical action.

The process is especially useful when making carbon enlargements, as a bromide enlargement takes the place of both the transparency and the enlarged negative, thereby saving considerable expense.

Unlike the carbon process the first transfer presents the image in its true position, as regards the right and left, thus doing away altogether with the labour of double transfer.

The working of the process can be carried out by any amateur photographer in the evening, the only preparation necessary being the getting ready of a few dishes. The carbon tissue, or pigment plaster, as it is called in this process, is not sensitized and dried as in the carbon process, but merely soaked in the patented Ozobrome pigmenting solution, then dipped into a very weak acid bath for a few seconds and applied to the surface of the wet bromide print The two papers are pressed together with a squeegee and left for about fifteen minutes for the chemical action to take place.

The print is now ready for development in warm water, or the two papers may be separated in *cold* water, and the impressed plaster squeegeed upon another support, thereby allowing the bromide print, after being re-developed, to be used again for the production of further Ozobrome copies.

Apart from a good bromide print or enlargement only the following materials are required :—

(1) Ozobrome Pigment Plaster—a special paper coated with pigment and gelatine which forms the image of an Ozobrome Print.

(2) Ozobrome Transfer Paper, which supports the image in its final state.

(3) Ozobrome Pigmenting Solution used to sensitize the Pigmenting plasters.

(4) A special acid bath.

It will be seen, therefore, that the extra outfit required by anyone wanting to work this carbon process without daylight does not entail any elaborate outfit.

First as to the Bromide Print. Any good print, on any paper, will suffice from which to make our Ozobrome, but if a number of prints are desired, it is advisable to use the specially strong bromide paper introduced by Messrs. Illingworth for the purpose. Either Amidol or Metol Quinol are suitable developers for the Bromide print or enlargement. The only suggestions that I may make regarding the Bromide print is that when fixing it an Acid Fixing Bath should be used if the best and most brilliant Ozobromes are desired.

Supposing we have our Bromide Print, then get ready the following baths :—

PIGMENTING BATH.

Ozobrome Patent Concentrated Pigmenting Solution as sold ..	1 part.
Water	4 parts.

ACID BATH.

No. 1, for soft effects.

Hot Water	20 ozs.
Chrome Alum (recryst.)	130 grains.
Bisulphate Potash	22 „
Citric Acid	10 „

No. 2, for strong effects.

Hot Water	20 ozs.
Chrome Alum (recryst.)	130 grains.
Oxalic Acid	22 ,,
Citric Acid	15 ,,

MANIPULATION.

(1) Place the Bromide print in water to soak.

(2) Immerse the pigment plaster in the Ozobrome pigmenting solution (working strength) until it flattens out, which will take in summer about 1½ minutes and in winter 2½ minutes.

(3) Remove the soaked plaster from the pigmenting solution and after draining for 15 seconds immerse it in one of the above acid baths for *a certain definate number of seconds* for certain groups of colours, as specified below.

(4) Transfer the plaster from the acid bath to the dish in which the bromide print is soaking, draw the plaster across the surface of the water to remove any superfluous acid solution, and bring the two papers into contact, withdraw them, clinging together, and squeegee into contact.

(5) Leave the adhering papers on blotting paper for 15 or 20 minutes for the chemical action to take place. Either of two methods are now available for completing the operations.

Method No. 1. (In which the bromide print forms the base of the picture). Place the adhering paper (after being in contact the requisite time) direct into warm water at 102 to 108 deg. Fahr., and after removing the plaster backing, turn the picture face downwards on the surface of the warm water and give it a to and fro or rubbing motion, which will remove most of the soluble gelatine, a dash or two of the warm water against the picture will complete the development. The plaster should be cut smaller than the bromide print for this method. Then fix in a 10 per cent. solution of hypo. for ten minutes, in order to remove the bleached silver image that is beneath the pigment image, and afterwards wash for 10 minutes.

Method No. 2. (In which the impressed plaster is transferred to a separate support, leaving the bromide print available for further use.) Slide a piece of transfer paper under the surface of clean water in a dish. Separate the plaster from the bromide print by a

steady pull from one corner ; place the bromide in a separate dish of water, and bring the impressed plaster into contact with the transfer paper under water. Remove and squeegee together firmly. Place between blotting paper under slight pressure for five minutes (not much longer), then develop in hot water as described in No. 1 Method. The plaster for this method should be larger than the bromide print and all Ozobrome plasters are supplied for full size.

The bleached bromide print is re-developed, after being carefully washed, in any Amidol or Metol-Hydroquinone developer, full strength but without any Potassium Bromide. This operation may be carried out in ordinary light or daylight, *and no fixing is required.* The print, after washing and drying, may be used again for making more Ozobromes.

TIME OF IMMERSION OF THE PIGMENT PLASTER IN THE ACID BATH.

The time that the plaster (impregnated with the pigmenting solution) should be immersed in the acid bath is dependent upon the colour of the plaster—the colours being divided into three groups, *viz.* :—

Colour Group A.—No. 58, Engraving Black. No. 60, Warm Black. No. 97, Blue Black. No. 75, Sepia. No. 51, Portrait Brown. No. 68, Dark Blue. No. 65, Sea Green. No. 59, Platinum Black. No. 50, Standard Brown. No. 76, Willesden Sepia, and similar colours containing black pigment.

Colour Group B.—No. 77, Warm Sepia. No. 88, Nut Brown. No. 70, Red Chalk. No. 83, Terra Cotta. No. 87, Italian Green, and the transparent Browns.

Colour Group C.—No. 82, Violet. No. 67, Milan Green. No. 84, Lilac. No. 85, Carmine. No. 86, Light Blue, and similar bright transparent colours.

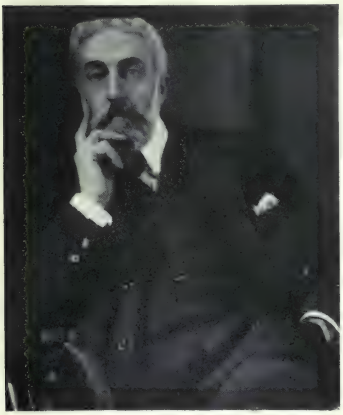
The times of immersion are :—

Group A, 15 seconds. Group B, 10 seconds. Group C, 7 to 8 seconds.

A shorter immersion of a few seconds will produce a stronger result, while a longer immersion will give a more subdued effect.

CHAPTER XVII.

The Rawlins' Process of Oil Pigment Printing.



SELF PORTRAIT, R. DEMACHY.

By ROBERT DEMACHY.

Honorary Fellow of the
Royal Photographic Society.

If a sheet of paper covered with a thin layer of gelatine is sensitized with bichromate, dried in the dark and exposed to daylight under a negative, it will be found that the surface of the print, after soaking some time in water, will retain unequally any greasy ink applied with appropriate tools. The positive image of the negative plate will be the result of this application. This unequal receptivity is due to the fact that wet and swollen gelatine in its normal condition will not retain greasy ink, while the addition of bichromate combined with the action of light on the same will tan or grain it sufficiently to retain the aforesaid ink. This explanation is so simple that oil printers are apt to forget it, without realizing that it holds the secret of success and the remedy for failure.

THE TOOLS.

My materials for working the oil process are all comprised in the following list: a 6% solution of ammonium bichromate,—double the quantity of pure alcohol—a drawing board—a flat hog's-hair brush for sensitizing—a dozen special (stag's-foot) brushes of different sizes, and two or three straight cut—a dozen sheets of thick fluffless

blotting paper—two thick glass plates—a tin of Valette's *Encre machine*—another of *Encre Taille Douce*—a tube of Roberson's medium—a roll of Illingworth's double transfer paper, No. 125—one of 119—one of No. 151 Gravure White. (The Autotype double transfer papers and Mr. Manly's specially prepared paper work well. I have not had the occasion to try Mr. Rawlins' last papers).

THE NEGATIVE.

Any description of negative may give a passable or even a good print with oils in the hands of an expert, but I prefer to work with the kind of negative that will allow me the greatest scope for freedom in treatment : one that is absolutely free from fog. It may be fairly dense or it may be very thin, but in all cases it must have clean shadows and translucent blacks. Over-exposed and over-developed negatives, of the kind that a sickly fashion has made popular for so-called pictorial effects, are eminently unsuitable for the oil process.

SENSITIZING.

To cover six whole-plate sheets of double transfer paper, take five cubic centimetres (1½ drams) of ammonium bichromate 6% solution, and add ten cubic centimetres (3 drams) of alcohol* (90 degrees). Pin a sheet of paper on your drawing board by its four corners, dip the extremity of your flat hog's-hair brush in the alcoholic mixture, draw it once horizontally along the upper part of the sheet, and with rapid downward strokes gather the solution from the top streak and cover the whole sheet. I have found that the quantity of liquid applied with the first horizontal stroke is just sufficient to cover the rest of the paper without superfluous flooding, which is sometimes difficult to remove equally, but only the tip of the brush must be immersed in the bichromate solution. The gelatine coating of double transfer papers is made so thin that it will only absorb a very small bulk of liquid. If the quantity applied is superior to the power of absorption, the solution will settle in small pools and it will cause streaks under the action of the brush. In such a case, the streaks may be removed by passing a dry and perfectly clean camel's-hair or badger softener over the still wet surface of the sheet.

This operation must be performed in subdued light and the wet sensitized paper removed immediately to a dry and perfectly dark

* Rectified spirits of wine may be used, but not methylated spirit.

place. Desiccation will be completed in ten to fifteen minutes according to hygrometric conditions.

EXPOSURE.

Sensitized paper may keep its qualities for several days—but also it may not. I have had fair results with sensitized paper a week old, and I have met with streaks and spots on a two days' old sheet. The moral is that we had best expose as soon as possible after the paper is quite dry. Thus one cause of possible failure will be eliminated.

Accurate exposure is always an important factor in photographic work. Here it becomes all important. It is all very well to talk about control and local inking, but control and local inking can only be used with an obedient film and the film is obedient only when its surface offers the maximum quality of love and distaste for greasy ink, if you will excuse such unphotographic terms. This special degree can only be produced by a special degree of exposure. Above this point, these qualities of love and distaste will merge into one of general acceptance of the greasy ink—below it, the quality of distaste will become predominant, and the ink will be repelled.

It is impossible to indicate an average time of exposure without talking actinometer. We will take the simplest form, the Artigue Actinometer. Smear a strip of ordinary white paper with your ammonium bichromate solution, without alcohol; dry it in the dark and slip it between the leaves of a book so that it protrudes by the length of an inch or so. Expose to light until the exposed portion does not darken any more. Then pull the strip out another inch, note the exact time and watch the darkening of the new portion. When the first and second have become equal in tone, note the time again. The number of minutes elapsed we will call an "Artigue Degree." It will vary from two or three minutes (in diffused light, of course) in summer, to half an hour or more in winter. The average good negative will take from one to one and a half degrees exposure; a very thin negative will print in half a degree.

WASHING.

I shall refer to what has been previously said about the keeping qualities of sensitized paper. For the same reasons it is wiser to wash the exposed print at once. This operation, for a batch of five prints, will take about twenty minutes, with half a dozen changes of water. Of course the first, second, and third changes must follow

each other rapidly. Tepid water will ensure faster and more complete bleaching of the image. A still more rapid result may be obtained by adding a small quantity of bisulphite of soda to the third bath and rinsing thoroughly afterwards.

SOAKING.

An hour in cold water, once the yellow stain has disappeared, or two or three minutes in lukewarm water will suffice, unless the print has been previously washed and dried. In that case it is better to let it soak for two hours, and to finish off with some lukewarm water.

THE INK.

The nature of the ink is most important. I have tried dozens of samples and I have also made some myself with the advice of expert engravers; and I have come to the conclusion that all sorts of inks, except the non-drying lithographic transfer ink, can be of use—but that only two samples will meet the everyday requirements of the oil printer. These, for France, are represented by the *Encre Machine* and the *Encre Taille Douce* of Valette's, both of which are quite free from turpentine. I use several other kinds of home and commercial manufacture, but only for special and rare occurrences. With an ink of the thickness of *Encre Machine* for fully exposed, and of *Taille Douce* for underexposed portions of a picture, one can work for months without feeling the want of any other ink. The day that want makes itself apparent, a simple addition of cooked or pure linseed oil will be sufficient to convince the oil printer that he had better print another picture with the right exposure.

Nevertheless, for extreme cases, I can recommend a prudent mixture of Roberson's Medium, but this medium contains a fair percentage of turpentine, dries quickly and consequently makes the coating tacky in a very short time. It is helpful when there is a necessity of darkening considerable areas of light tones, but I should advise nobody to use it as an habitual adjunct to engraving or machine ink—only when soft ink will not *take* under ordinary conditions.

INKING.

When the gelatine print has been well soaked it must be placed in full light on a pad composed of at least half a dozen sheets of thick fluffless blotting paper, quite wet, and the gelatine surface thoroughly

wiped with clean butter muslin. This must not be done timidly—there is no danger whatever of hurting the film. Examine the print from an angle and remove any drop or streak of water that may have remained. Then with an engraver's palette knife spread a small quantity of soft, and further on, of hard ink on a thick glass plate.

I have found that it is no easy undertaking to teach a beginner how to handle his brushes "*in anima vili*"; I know that it is next to impossible to describe the inking action in print with sufficient accuracy to ensure adequate rendering of this action on the part of the reader. Perhaps it would be wiser to warn him against the things he is *not* to do?

Let him first bear in mind that every application of the ink-charged brush is composed of two actions, each of which produces an opposite result—the downward and the upward action—separated by a period of contact, which we must admit is part of the first and downward movement. This first movement brings the ink into contact with the film. The second movement removes it, wholly or partly. These two actions may be so well balanced that no result will be perceptible, the ink applied by the downward action having been completely removed by the upward one. It follows that, according to the delicate pressure of the hand in applying the ink, and according to the varying elasticity of the wrist in removing the brush from its close contact with the film, varying quantities of ink may be applied or brought away.

What the beginner ought *not* to do is to use his muscles. Oil printing is distinctly not an athletic pastime, and a man who plays the violin well, and has a supple wrist and independent fingers, will learn the trick of inking ten times faster than one who makes exclusive use of his biceps. Yet without going so far I have seen delicate young ladies bang away at an innocent oil print in such a manner that the ink was literally crushed over certain parts and entirely removed from others, with such disastrous irregularity that I was unable to recognise if the pictures in question were over, under, or correctly printed. One of these ill-treated oil prints I irreverently washed with automobile essence, soaked and inked anew, with entirely satisfactory results! Which shows that given correct exposure, proper brushes and proper ink, an oil print may still refuse to develop if attacked in the wrong way.

Let the beginner exaggerate at first the delicacy of his touch, let him start with a brush lightly charged with No. 1 ink, well crushed

and dabbed on a clean glass palette. If the ink does not take it may mean that the print is under-exposed, for both inks, or only for this particular ink, but before experimenting with a softer ink, let the beginner change his touch and give more length and insistence to the first half of the inking action (the downward movement). He may discover that there is nothing the matter with the exposure, and even less with the ink, and that it is his brush action that is to blame.

The most logical manner of acquiring reliable experience in the matter of exposure and its results *versus* inking, is to give three different exposures to three different portions of the same print. Divide your negative into three vertical bands by making two visible marks at equal distances on the glass side. Mask the two first bands and expose the third for half a degree Artigue, mask the first and the third and expose the middle band for one degree and a half, cover up both exposed bands, and expose the last for three degrees. Then wash, soak and ink. Such an experiment is worth pages of theory, and if the beginner is not sufficiently edified by the difference of behaviour between the first and the last band, let him double the exposure of the latter. If this does not teach him what effect variations of exposure can produce on subsequent inking, nothing else will.

SIGNS OF OVER AND UNDER-EXPOSURE.

It must be understood that, by the terms over and under-exposure, I intend to convey the idea of a *general* excess or want of exposure, for, in one and the same picture, correctly exposed as a whole, certain parts will be over and others under-exposed for one and the same quality of ink. Example : a landscape negative taken on a bright day, will, if correctly printed for the foreground and distance, show signs of under-printing for the sky, which will be obliged to be toned down to a monochrome value equal to that of a dark blue sky by using No. 2 ink, or even by adding to this already soft ink a drop or two of medium.

The signs of general over-exposure are lack of contrast, and consequently loss of detail and contour. All the planes will take the ink equally or nearly so, and the result will be flat, even with the harder ink, much more so with the softer. But nearly similar results will attend when a grossly under-exposed print is persistently dabbed with soft ink. It will become soiled all over without producing contrast. This particularity may deceive the beginner, but if there is any doubt on the question of exposure, let him try to wipe the ink

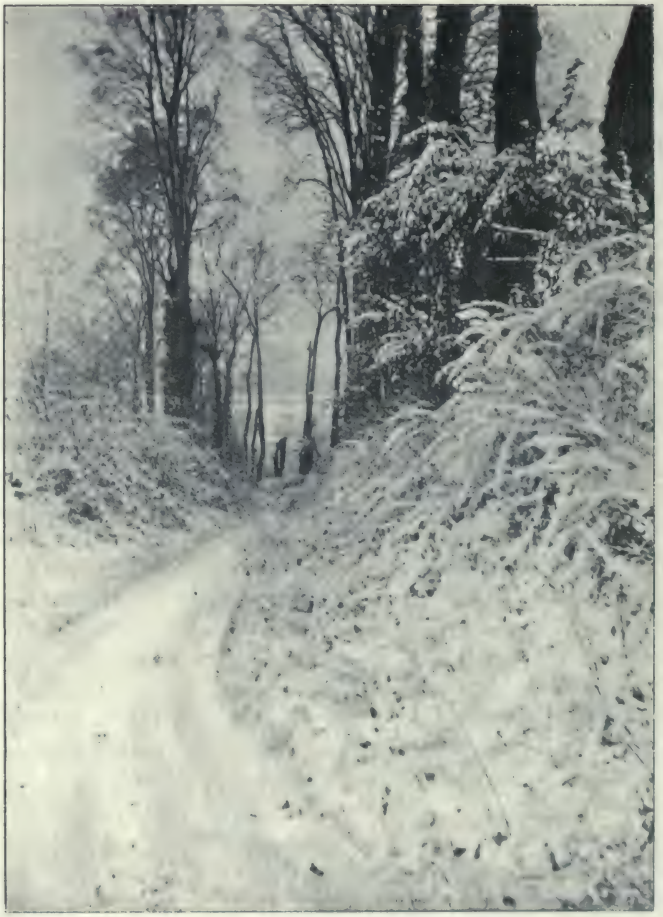
off from the lighter half-tones with a wet hog's-hair brush or a wet pad of muslin. In the case of under-exposure, the ink will be removed at the first stroke, leaving the gelatine surface perfectly clean. With an over-exposed print it will take a deal of rubbing, and the surface will remain spotty. This is a useful test that never fails.

Of course, no definite instructions may be given on the subject of *interpretation*. The oil process confers the faculty of altering every value of the original picture; that is quite understood. What has been made less clear is that the purely photographic values of most straight prints are not *all* wrong; it is their relation to each other which is generally faulty, but in many cases only one or two portions of the picture will need darkening, or lightening to a certain extent, which must be the proper extent. Photographers will not learn when to correct, and especially when to stop correcting, by consulting text books, but by studying nature and the work of real artists in black and white. A year or two of constant study will make them realize that they still have much to learn in that quarter. I have been studying for years, and am still learning. I can do no more, as I have already said, than to describe as accurately as possible what I believe to be the surest way towards producing an obedient gelatine surface.

We can now pass to the last technical stages of the process. They are simple enough. The oil print when finished will have to be pinned securely on to a drawing board by its four corners, and placed near a stove or hot air furnace. The gelatine film will be dry in half an hour, and the ink in several hours or several days according to the way it has been laid on, and to the nature of the paper. On matt-surfaced papers, the coating of which is very thin, desiccation is far more rapid than with smooth or shiny surfaces.

A perfectly dry print will, of course, show a certain change in its values. Both blacks and whites will appear duller than when the print is wet. In most cases the highest lights will have to be quickened with the point of a sharp scalpel or with a pointed indiarubber eraser. In fact, at this stage, any passage from black to pure white may be effected in the same manner, but it must be borne in mind that over-indulgence in after-retouching will tend to unduly soften the outlines of the picture. I have seen many fairly good pictures spoilt in that way.

On the other hand, if there is any need of *raising* a value, the only practical way will be to soak the print anew in tepid water and ink locally over the freshly swollen gelatine. Soft ink should



R. Demachy.

FROM THE BROMIDE PRINT.

R. Demachy

FROM THE OIL PRINT.

not be added to a dry print for it will take anywhere and everywhere, no underlying relief will be there to guide the brush and the lens drawing will be lost.

VARNISHING.

Prints on matt paper may be varnished when quite dry with Soehnée's varnish for water colours, or ordinary wood varnish, or a mixture of both, to which equal parts of spirits of wine will have to be added. It will brighten the inked portions of the print and sink through the unprotected portions. Smooth and heavily coated papers will retain the varnish on their whole surface, and a disagreeable glossy effect will ensue.

FRAMING.

I should not recommend close framing for oil prints unless they be particularly strong—stronger indeed in tone and contrast than the frame itself. The style of framing adopted for engravings, with a narrow vignette of pale natural wood and a rather wide margin of Japan tinted paper, seems the most suitable for this kind of work.

A half-tone reproduction of a straight bromide and one of an oil print from the same negative are shown on pages 129 & 130. I know from previous experience that most people will prefer the bromide, but this is a matter of taste. Still the comparison may be interesting to the few, from the point of view of values and their effect. It will be noticed, if the half-tone process has not played false with the originals, that: Firstly, the relative values of the sky and snow have been altered, the sky value having been lowered and the snow highlights in the foreground brought to nearly pure white. This lightening of the snow has darkened the value of the trees—by contrast only—and brought the effect nearer to that of nature. Secondly, the patchy foreground on the right side of the bromide picture has been more broadly modelled by local inking and most of the complicated branches and brambles have been sacrificed for the sake of simplicity. Thirdly, the second plane on the left side has been still more simplified, and the background on the same side has been allowed to melt in a sort of distant haze. Also the two irritating stumps in the central distance have been entirely suppressed.

The key-note of the picture is meant to be found in the close contrast between the deepest black and the highest white which is produced by the upper snow-laden boughs, and the trunks of the tall trees on the right.

ROBERT DEMACHY.

CHAPTER XVIII.

The Bromoil Process.*

C. H. Hewitt.
By Furley Lewis.

By C. H. HEWITT, F.R.P.S.

Christened by Mr. F. J. Mortimer, one of its ablest exponents, Bromoil is, as one would surmise, a combination of bromide printing with the oil pigment process. In the Rawlins' process of oil pigment printing, paper coated with bichromated gelatine is exposed through a negative, the varying degrees of light action producing varying degrees of insolubility. As the temperature of the soaking water is not raised very high, the gelatine does not dissolve, but merely swells, a good deal in the unexposed portions, less in the half-tones and very little or not at all in the deep shadows. This unequally swollen gelatine image is pigmented with a somewhat stiff greasy ink, the pigment adhering most where the gelatine has swelled least.

In Bromoil, an exactly similar condition of gelatine film must be produced; but this is done by the application of two or three solutions only and without the necessity of daylight for printing. The reduction of the potassium bichromate necessary to produce the insolubilizing of the gelatine, which in the oil process is due to light action, is, in Bromoil, obtained by chemical means.

Before going into the details of the methods, it may be well to point out one or two advantages the process enjoys. Neither oil nor Bromoil printing will be used to any extent for small direct negatives such as the majority of workers obtain with the almost universal small camera. While the Bromoil process only requires

* Abridged from "The Oil and Bromoil Process" issued by the Publishers.

a Bromide print or enlargement, the oil process usually necessitates the making of an enlarged negative, for the negative must be the same size as the print desired.

Such an enlarged negative may not be difficult to make, but positive, negative, and print, it must be admitted, is a lengthier and more troublesome way than a print direct, and a print made by projection in the lantern is as easily produced as by contact in the printing frame. There is, further, the obvious question of cost. A 15 × 12 plate represents one and sixpence as against a trifle over sixpence for a sheet of bromide paper, and this ignores the few pence for the sheet of oil printing paper.

In the oil process there are certain difficulties which occur when dealing with the chromic salts in conjunction with gelatine. The paper must be freshly sensitized, and precautions must be taken against damp and faint light fog. The printing of the sensitive paper needs to be carried to the exact point with considerable nicety ; with Bromoil, a good, clean bromide print of average strength is required, and this one can be certain of having before the work of preparation and pigmenting is commenced.

THE BROMIDE PRINT.

Little need be said with regard to the preparation of the bromide print. Care must be taken in handling the paper to avoid finger markings and also creasing and kinking, which, under certain conditions would be likely to induce blistering. The print *must* be developed fully with the amidol or the metol-hydrokinone developer, and it must be well fixed and well washed and should, preferably, be dried before further treatment. It will be found that the better the bromide print the better will be the resultant bromoil, and the easier and more straightforward the operation of pigmenting. Poor, weak and washed-out bromides will not yield good bromoils, and my own experience is that the bromide print needs to be rather on the dark side if the older type of bleacher is used. With the Sinclair Bleacher, to which I refer later, a normal print will work perfectly.

As to the choice of paper it may be necessary to say something. Most of the ordinary papers (in contradistinction to the platinomatt) are excellent, pigmenting readily and withstanding quite as much brush action as should ever be required. Experiments have shown their ability to withstand a sufficient amount of " hopping " even if a hog-hair brush is used.

If the temperature should be so high that the gelatine becomes too swollen and soft, the use of ice may be resorted to, and I have found that a small piece in each of the solutions, with a larger piece in the dish in which the print is rinsed between the various baths, is a satisfactory plan, the very slight weakening in strength of the solutions being unimportant.

And now to the working and solutions.

Since the earlier editions of this brochure were published a number of other bleaching solutions have been suggested and tried. Development has proceeded in two directions—towards simplification and towards efficiency. The abolition of the sulphuric acid bath not only simplifies the process but avoids the risk of accident. The less deeply printed bromides are less likely to show a strong residual image, and so the final colour of the bromoil will approximate more closely to the colour of pigment used.

An excellent formula published some little time ago in the pages of the "Amateur Photographer and Photographic News" is as follows :—

COPPER BROMIDE BLEACHER.

10% solution	Copper sulphate	6 ozs.
10% ,,	Potass. bromide	4 ,,
10% ,,	Potass. bichromate	2 ,,
Water		40 ,,

Add a few drops hydrochloric acid to clear the solution. If a bleacher ready to hand is desired, nothing will be found to work better than the Sinclair Bleacher. I have now used it for a great number of prints and have found it excellent with all prints except those heavily printed from strong negatives, such prints, in fact, as would be deliberately made for the older or ozobrome type of bleacher. Where prints or enlargements are being made purposely for bromoil and from average negatives, I prefer to keep them normal in strength and use the Sinclair bleacher. Under these circumstances I use Amidol as a developing agent, and give just sufficient exposure to render high-light gradation, developing very slowly. Should the print be over-exposed and taken out of the developer before the developing action is completed, a good result in Bromoil must not be expected. The objection to working with hard prints is that a coloured deposit always remains in the bleached shadows, and this impairs the final result. The prints, when developed, should be fixed

C. H. Hewitt, F.R.P.S.

FROM THE BROMIDE PRINT.

The great difference between these two prints is considerably minimised by the half-tone process. In the Bromide the sky is perfectly white. The block improves this into a tint, and at the same time reduces the value of the sunlight on the cottages in the reproduction of the Bromoil.

C. H. Hewitt, F.R.P.S.

FROM THE BROMOIL PRINT.

in plain hypo and water—an acid bath must not be used. The print, having been fixed, washed and dried as usual, may at any time be converted into a Bromoil print. Some workers have found that old prints are not so suitable as those freshly made, but I have never experienced any difficulty with prints three months old. However, this varies with the water supply. The water in some districts renders it necessary to bleach as soon as the hypo is washed out of the enlargement and *before drying*.

BLEACHING THE PRINT.

Immerse the print in water till quite limp and then flow over it a solution consisting of :—

Sinclair Bleacher	1 part
Water	2 parts

To make up this solution place 2 ounces of warm water in a measure, and add 1 ounce of the bleacher. Keep the dish containing the print moving till bleaching is thoroughly completed. Time depends on the make of bromide paper, some makes bleaching in 2 minutes while others may take 20 minutes. Continue the action for about 2 minutes after the action seems completed. The used bleacher is then poured into another bottle and may be used many times in succession, a little fresh being added when it works slowly. Now wash the print in several changes of water " with the chill off " for 5 or 6 minutes, and fix for the same time in :—

Hyposulphite of Soda	1 part
Water	10 parts

at a temperature of 75°F. This removes the bleached image.

In the winter months and with Ilford papers I find it possible to use all solutions at a temperature of 85°F.

WASHING THE PRINT.

Some makes of papers seem liable to blisters, but I have never found any trouble when working as follows. Instead of taking prints out of the fixing bath and transferring to a dish of water, I pour tepid water into the fixing bath, a jugful at a time, keeping the prints moving all the while. By this means I gradually dilute the hypo, and the gradual instead of violent change of density in the solution obviates all trouble. The print, after washing, is ready for pigmenting, and may be first dried, the gelatine sometimes being in a better condition for pigmenting if this is done. This appears to be necessary when the print is very delicate.

PREPARING FOR PIGMENTING.

The print must now be placed on a pad consisting of several thicknesses of thoroughly wet blotting paper laid on a sheet of *stout glass. A roller squeegee passed lightly over the blotting paper will drive out superfluous water while leaving the paper still quite wet. The print is now laid down and its surface gently wiped or dabbed with a piece of well-washed butter muslin, or a clean soft linen handkerchief. This must be done more gently than in the case of an oil print. When the surface is free from any visible moisture it is ready for the application of the ink or pigment. The Sinclair inks are those I have been using since their introduction. They dry quickly and without loss of lustre, and work well with either hog-hair or fitch brushes. I find it usually necessary to thin them a little on the ground opal palette with the special thinning medium, but this must be done gradually until just that consistency is obtained which suits the particular print in hand. The pigmenting of a Bromoil may be done rather more boldly than in the case of an oil and with a dabbing action, but I do not advocate the application of an excess of ink, for while it may be found easy enough to get the pigment off the lighter parts the shadows may not yield up the ink so readily, and a rather hard print may result.

DETAILS OF PIGMENTING.

Beginners find much difficulty in pigmenting the prints, and have no idea how much ink to put on the brushes, or how to transfer the ink from the brush to the print. The following materials are required :—

A Palette—preferably a piece of plate glass, ground on one side about 9×7 inches.

A Palette Knife.

Some Pigments in pots or tubes.

A Tube of Medium.

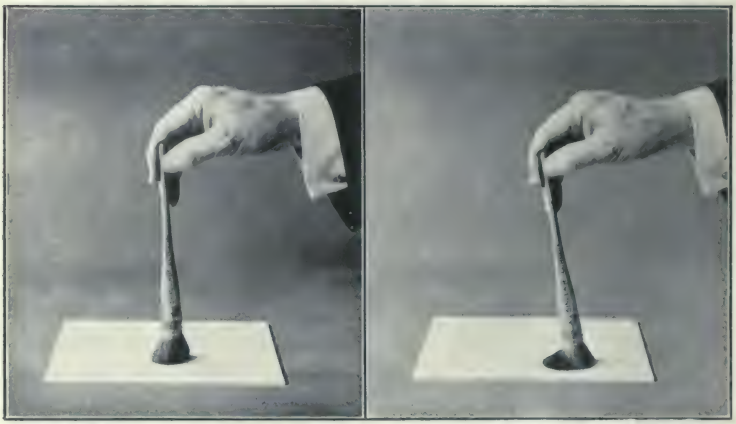
As many Brushes as the worker can afford, of various sizes.

A Hopper.

It is important to use the proper kind of brush. Cheap brushes are a delusion. The proper kind are made from hair of the pole-cat, and have the hairs arranged in the shape of a stag's foot. While two or three brushes may be ample for small work, from nine to

* A Hewitt Bromide Desk will be found a great convenience. ED.

twelve will not be too many for 12 × 10 prints. Perhaps the most useful brush for any size up to 10 × 8 is No. 14, and in any case, where only one brush is required for trial work, I do not suggest a smaller size than No. 12. These should be supplemented with a few smaller brushes for detail work.



Brush Action. Fig. 1. Fig. 2. *C. H. Hewitt.*

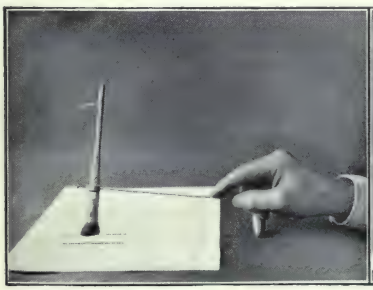
To start work squeeze out some pigment on one corner of the palette, and by its side a little of the medium. Add ever so little medium to the ink by means of the palette knife, and gradually work up the mixture to the consistency of putty and spread it down the palette, so that there is a very thin coating. If the brush is now dabbed on the palette where the pigment is thin, with a quick action it soon gets a little on the tips of the hairs, the only part where it is required. A few taps on the clean portion of the palette will equalize the pigment, and if it is right for starting work it will show by giving an even deposit or stipple to this part of the palette.

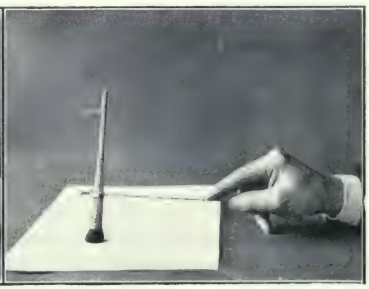
Now for applying the pigment to the print, and there are several ways in which this may be done, though most of them are modifications or combinations of those here illustrated.

Method I. Take the brush charged with pigment and hold it at the end with the first two fingers and the thumb, so that it can swing easily in any direction. Lower the brush on to the print and gently dab the surface with a rapid action, four or five times in a second, and in such a way that the brush hardly leaves the

Brush Action. Fig. 3. Fig. 4. *C. H. Hewitt.*

surface of the print as shown in Figure 1. This action may be alternated with that shown in Figure 2 in which the handle of the brush points forward, and this results in each dab or tap forcing the brush gradually from the top to the bottom of the print, the dragging action leaving a little ink in places where the gelatine is receptive. After working for some time all over the print, and getting our picture outlined with the stiff ink, we may slightly reduce the consistency with more medium, and the thinner ink will begin to take in places which rejected the stiff ink, particularly in the half tones of the picture. Where there are strong shadows, be sure to get sufficient of the stiff pigment to form a ground work before reducing the consistency, because the gelatine will only absorb a certain amount of pigment, be it thick or thin, and if we let it absorb thin pigment in the first instance, we may fail to get sufficient depth of colour.





Brush Action. Fig. 5. Fig. 6. *C. H. Hewitt.*

METHOD II. Figures 3 and 4 illustrate this method. Here the brush is held much lower and with a decidedly firm grip. In Figure 4 we see it being applied with considerable vigour to the print, the action being a slight dragging action, from heel to toe of the brush, and almost working in a circle, the brush touching the print for say, three-quarters of the down movement and one-third of the upward movement. This method is recommended where strong effects are desired.

THE HOPPER. This is a very useful adjunct to the oil printer, and its use is seen in Figs. 5 and 6. A print may be pigmented entirely by means of the hopper, but I do not recommend this being done. Rely on the brush held in the hand, and use the hopper for special purposes. Generally speaking, the hopper should only be used in such a way that the brush is lifted about ½ inch above the print. The action should generally be rapid, and if the hopper is held with the fore-finger along the wire it may be very exactly controlled. To bring out detail or contrast in any one part, it may be necessary to use the hopper more vigorously, raising the brush 2 or 3 inches, but such action should not be prolonged, or the print will be covered with broken hairs from the brush.

It should be remembered—

"That a slow dragging action deposits pigment on the print, and tends to softness."

"That a quick action with a brush charged with pigment tends to contrast."

"That stiff inks give contrast and lack of detail."

"That thin inks give detail and lack of contrast."

"That a quick dabbing action with a dry brush removes ink and gives softness."

I have remarked that the ink should be stiff to begin with, and should be very gradually thinned down until the print commences to take it. As soon as this occurs, the print may be pigmented boldly and freely. A great many failures, I believe, occur because the pigmenting is commenced timidly. Of course, light portions of the print need not be smothered with ink; they may be treated with a partially emptied brush, but—assuming the print has proper relief—the darker portions may be boldly covered. The top right-hand corner of the illustration shows how bold this pigmenting may be. Such an effect frightens many workers, who remember the

earliest instructions in pigment printing about applying the ink in extremely attenuated layers.

Of course, one does not need to apply pigment merely for the fun of removing it again later. In the illustrative print the cottages on the left and the distant hill might be pigmented with a brush half emptied of ink. In other words, when the brush has been freshly charged with ink it should preferably be used first on the darker portions, and then, when nearly ready for re-charging, some lighter portion of the print, such as the distance, may be worked on. Thus, the top right-hand corner shows bold pigmenting with a fully charged brush—the brush, in fact, being returned to the palette for more ink after every three or four dabs. But such a part as that immediately to the right of the vertical line C D would be worked with a brush almost emptied of ink.

It is a great advantage to work quickly, and to get the whole of the print covered with the film of greasy ink. This appears to prevent the rapid evaporation of the moisture on the surface of the gelatine. But it is not a good plan to omit the sky when thus working, for it will sometimes happen that the edge of the pigmenting cannot in such a case be obliterated when the sky is afterwards commenced.

Having roughly covered the print, with the above-mentioned due regard for the required tones, the brush may be worked over and over again on the various portions, without, of course, recharging it with pigment. This working equalizes the ink over the print, removing the patchiness and bringing out detail. The gable-end of the timbered cottage shows the effect of this smoothing up. With some prints this equalizing process not only gets rid of the irregular dabs, but also produces sufficient contrast. This depends on the character of the subject, the effect desired, the strength of the original (negative and) print, and the amount of relief obtained in the preparation of the print. Supposing, however, that in the nearer portions more contrast is required, " hopping " must be resorted to. That portion of the print below the line A B shows the effect produced by " hopping."

Referring again to the distance, the part to the left of the line C D has not been hopped, but only equalized by gentle dabbing. Were this portion hopped, it would in all probability acquire too much contrast, and so cease to be in the middle distance. We thus

By Courtesy of "The Amateur Photographer."

see that " hopping " gives strength and vigour, while a more gentle brush action softens contrast and enables the worker to keep the distance in its proper place.

Difficulty is sure to be found in working the sky. That portion below the line E F shows the sky roughly inked over, while the upper part shows how it may be evened by continued dabbing. It must be remembered that the sky, being often quite white, or, at all events, very light, will have a tendency to refuse the ink. It may, therefore, be necessary to slightly thin the ink for working up the sky. A plain sky may be worked in, keeping it slightly lighter towards the horizon. If desired, clouds may be added, hopping out the lighter side of the cloud and dabbing in the shadow side, for it must be remembered that a cloud is a more or less rounded mass. This naturally requires a good deal of practice, practice based, too, on careful observation of cloud forms. It will be found difficult, if not impossible, to get the light edges of cloud coming against the blue sky sufficiently crisp in places, but when the print has dried for four-and-twenty hours, one or two crisp touches may be added with a bit of pointed rubber, taking great care not to overdo this and produce too much defined edge.

THE FINISHED PRINT.

The prints being finished, we may want to touch out defects or alter certain values, and perhaps a word or two on means for the purpose may be acceptable. In our early essays we shall be troubled with hairs coming out of the brushes or short pieces of hair which have broken off during work. Proper manipulation of brushes and pigment reduce these troubles to a minimum, but should they occur, don't worry about their removal from the wet print. After the print has been dried by hanging it up with print hangers for say a day, the greater number of the long hairs can be removed or brushed off with the tip of the finger. Small pieces of hair and pigments can be scraped away by means of a " retouching pen " and such retouching pens are also useful for scraping in a high-light on a dry print. Where it is desired to put in a high-light on a wet print, plastic rubber, moulded to a point in the fingers, will be found a great boon, while ordinary rubber of good quality will be found useful for lightening portions of dry prints. The ball of the finger rubbed over any portion of a print that is nearly dry will soften down any harsh contrasts wonderfully, but generally speaking it is better to get the effect during the pigmenting.

As to the artistry of pigmenting it is scarcely possible to say anything. Everything depends on the worker himself. Bromoil will give what is practically a straight print, but of quite a different character and quality from the original bromide. It will enable the worker to make slight modifications in effect, such as that in the pair of examples I have chosen to illustrate this note. The production of a goodly number of Bromoil prints has shown pretty conclusively that the process places as great a power of control in its user's hands as the oil process itself.

MOUNTING THE PRINT.

Care must be taken to get the print thoroughly dried before mounting. Should it be necessary to mount immediately after pigmenting, first dry the print, then let the steam from a kettle play upon the pigmented surface and dry again before a fire. It is a curious proceeding to use moisture for drying the pigments, but apparently the steam has an oxidizing action on the oil in the ink, and the treatment suggested renders it less liable to damage ; but at all times care must be taken that there is no rubbing or unnecessary handling of the surface, which, for some days at least, is delicate. If there is no urgency it is certainly better to keep the print for some time before mounting. When the print is thoroughly dry, the dry-mounting process may be used, but when mounting within a few hours after pigmenting, it is safest to place the print face downwards on a sheet of waxed paper, and well rub into the back by means of the finger, some Johnson's Mountant, then place in position on the mount, lay a sheet of waxed paper on the surface and roll lightly with a roller squeegee. The edges may possibly show some little signs of coming away from the mount, particularly when the print is on a thick paper, but if a sheet of plate glass is placed on top of the Bromoil and it is left for five or six hours, the result will be found quite satisfactory.

CHAPTER XIX.

Multi-Colour Bromoil Prints.

The Methods of R. MACFARLANE COCKS and HALDANE MACFALL for Producing their Bromoil Prints in Colour.

Messrs. R. Macfarlane Cocks and Haldane Macfall (the latter the well-known art critic), who have been working in conjunction on the subject of bromoil in colour, recently lectured before the Camera Club, and we have been favoured with a copy of their notes, and from these, in conjunction with an excellent report in the "Amateur Photographer," we have extracted particulars of their methods. Mr. Cocks, in his remarks, pointed out that they had only two real failures to produce a workable print, and these were owing to the use of a brand of bromide paper not hitherto tried, but recommended by a bromoil worker. Although, apparently, one of these bromide prints was a good one, they could not get it to take the colours, while in the other case they had a very weak print, which would not satisfactorily ink up. As for the papers they found that Kodak (White) Royal worked the best of all the makes thus tried. Their practice was as follows :—

THE SUBJECT. THE NEGATIVE. Selecting a subject that had been taken with a special view to colouring, and of which they had made a sketch and notes for guidance in after work, and of which the negative was of good quality and of medium density, but not hard, they made two enlargements on the papers described as being most suitable for the process. The object of two enlargements was that one of the prints might serve as a guide for the gradations when working up its fellow. These enlargements were developed to the fullest extent, for it was essential that the prints should be strong and rich in silver, but certainly not fogged ; still it was necessary to make a print which would be stronger than would be required for monochrome bromoil, for without such a strong print a strong colour effect could not be produced. Should, however, a very delicate print be required, the bromide enlargement need not be so rich in silver, though they had found a strong bromide might be so pigmented as

THE BROMIDE ENLARGEMENT.

to look delicate in colour. So far as a developer was concerned, they always used Amidol and Neutral Sulphite of Soda, and fixed the developed enlargement in non-acid hypo.

Hyposulphite of soda	3 oz.
Water to	20 oz.

After fixing, the print was well washed and then dried and could be prepared for pigmenting at any future time in twenty minutes.

THE BLEACHING. Before bleaching, they sometimes found it an advantage to faintly outline the subject in pencil for guidance in colouring, because their practice was to practically remove the whole of the silver image and any stain left in the silver. After soaking the bromide print in water for a few minutes it was removed, allowed to drain, and then immersed in a bath of "Sinclair" Bleacher, at a temperature of 65 to 70 deg. The print, being thoroughly bleached, was next rinsed, and then transferred to an *acid* hypo bath, made as follows :—

ACID HYPO AFTER BLEACHER.

Hyposulphite of Soda	3 oz.
Metabisulphite of Soda	½ oz.
Water to	20 oz.

The temperature of this bath should be from 60 to 65 deg. F., and they found such an acid fixing bath entirely removed the stain of the bleaching bath and did not interfere with pigmenting afterwards. Two minutes in this bath was ample.

FINAL WASHING. After removing the print from the acid fixing bath it was rinsed well in tepid water, and then soaked in another bath of tepid water, 65-70 deg. F., for ten minutes, face down, and during such soaking, and in order to ensure the print being well immersed, they laid on the back of it a vulcanite stirring rod or a sheet of blotting paper. The print then appears as *blank white* paper.

PAD FOR PIGMENTING. The print was now ready for pigmenting, but it was essential to keep it moist till the work was finished. On a sheet of plate glass was laid a pad of wet blotting boards covered with a piece of clean linen. On this the wet print was placed, and the surface carefully dabbed with a clean linen cloth—an old handkerchief was excellent—so that all the surplus water was removed. The pad upon which the

print was worked requires frequently wetting, and to do this the print may be lifted and water applied with a sponge.

One of their greatest difficulties was to keep the palette and print in good working order for several hours, perhaps a whole day, for a 20 × 16 print sometimes required this and even more. When the work was thus prolonged, it might be necessary to sometimes immerse the print for a second time in water, and afterwards absorb the surplus water off the surface, with a piece of clean linen, and this would not be likely to take off any appreciable amount of colour.

THE PALETTE OF SEVEN.

Mr. Haldane Macfall said a safe method to commence pigmenting, generally, was to cover the print with a pale blue (cobalt and white mixed) as a means of inking up the picture to see where the colours should be laid on, and the best results were found to be procured by the use of the pure colours of the broken-colour impressionists, such as the red, yellow and blue of the three-colour reproduction processes. As the colours of the process printers were, however, somewhat harsh, they took cobalt, cadmium yellow and vermilion as primaries and supported them with certain enriching colours which saved over-teasing the gelatine of the bleached print. "The palette of seven" consisted of—

Black.
Cobalt with French Ultramarine in support.
Emerald Green Oxide of Chromium (transparent).
Raw Umber with Red Chalk (or Light Red) in support.
Vermilion with Rose Madder in support.
Cadmium Yellow with Orange Cadmium in support.
White.

The Sinclair pigments were used and some of them were specially made.

They found the cadmium yellow and orange very useful working colours, which should not be allowed to foul, as they then go too low in tone. The same remarks were applicable to cobalt and vermilion. Raw umber, although useful, was certainly dangerous if used on the print by itself, because it gave a sort of photographic tintedness, and wherever possible red chalk should be used in its place. However, when mixed on the palette with the chalk, it gave a rich warm brown.

Emerald green was sometimes very necessary and effective. Black must be used sparingly and only as a last touch to a boot or other dark object. As for the white, this should not be used by itself alone, but was very useful for making lighter tints, by mixture on the palette, such as a rose pink, when added to vermilion, pale blue with cobalt, etc.

PREPARING THE PALETTE. For the purpose of mixing the colours they used an old lithographic stone upon which each colour was evenly spread. It will be found that the patches of ink on the palette are liable to dry very quickly in a warm room, and require carefully watching and frequently working up with a little medium. Care should be taken to use a separate brush for each colour, marking the handle near the brush end with patches of the colours in use.

APPLYING THE COLOURS. When starting pigmenting some detail, such as a head, it might be tackled first and completed, or perhaps preferably the print might be gone over as a whole in a pale hue of one of the primaries and the other colours afterwards worked in as before described. They understood that the process-worker always printed in a yellow key first, and likewise, in this bromoil colour printing, they had found that the yellow over all gave good results with some subjects, the other two colours being worked into it subsequently. It was remarkable and should be noticed particularly that the red, blue and yellow by combination produced almost every colour desired. With seven colours and their supports the range was limitless. They suggested that it was well to employ the most vivid colours possible for any subject, since the trouble was to retain the vividness, which if not carefully handled resolved itself, by mixtures, into low tones, and the tinty photograph was upon them.

The method of applying the colours was as in ordinary bromoil, the brush was held at the extreme end of the stick and dabbed and dragged upon the print with a stencilling action. It was well to avoid hopping as much as possible, as this action was liable to damage the surface of the gelatine. If the print is in good working order the hopper will only be required to obtain the highest lights and sharpest detail. Never allow the brushes to get clogged up. Frequently wiping them on a moistened petrol rag will keep them clean.

MR. HALDANE MACFALL ON THE RESULTS.

Mr. Haldane Macfall placed upon one side all purist hair-splitting as to whether colour-printing is or is not permissible in photography. He took it for granted that oil or bromoil prints in monochrome were photographic prints. If the gelatine image might be bleached and the bleached image dabbed with one colour, it stood to reason that the application of many colours laid upon the gelatine image was as correctly photography as the laying on of one colour. That was what Cocks and he had done, and he pointed to a dozen or more framed colour-prints (some of which were on exhibition at the Salon) disposed around the room as examples. They included scenes under Moorish skies, silvery-green landscapes, portraits, and even Continental festivals with their array of colour. They were, he claimed, just as much photographic prints as a colour-etching was an etching, and in brilliancy, vividness, subtlety, delicacy, the results which the process might yield were as good as water-colours.

"A NOCTURNE." *Reginald C. Chapman.*

Awarded the Second Prize in the Sinclair Oil and Bromoil Competition.

CHAPTER XX.

Multi-Colour Bromoil Transfer.

MR. C. F. STUART'S METHODS.

Amongst the most notable colour subjects that have recently been produced by the Bromoil process a leading place must be given to the work of Mr. C. F. Stuart, of Liverpool. Mr. Stuart's work has been always noteworthy for the feeling which characterizes it, and his new essay into the region of colour will maintain and enhance his reputation. Needless to say, such work does not escape adverse criticism, but such criticism is due to the different points of out-look from which the artist and the critics survey the subject.

The reason Mr. Stuart's work has found very general acceptance amongst those who have examined it is the fact that he pays particular attention to tone values, and his colour treatment is subservient to this very important factor.

So that we might better inform our readers as to the details of the methods pursued by Mr. Stuart in obtaining his very delicate results, we journeyed specially to Liverpool to hear his lecture before the Liverpool Photographic Association, one of the oldest, largest and most important associations in the country.

THE SUITABLE NEGATIVE.

Mr. Stuart began by describing the subjects that were best for multi-colour Bromoil transfer, and suggested such as consisted of broad masses of half-tone and high-light, but did not consider that subjects where there were larger masses of heavy shadow were suitable. The negative should be one similar to that used for making the best Bromoil prints, namely, clean and thin, and not strongly developed in any part, in fact, what might be termed a "Bromide" and not a "Platinotype" negative. From this negative a Bromide enlargement was made, and, naturally, the process being a transfer one, it was necessary to reverse the negative in the enlarging lantern, so that the glass side instead of the film side faced in the direction of the Bromide paper. This resulted in a reversed Bromide enlargement such as was necessary for the purpose.

THE BROMIDE PRINT.

While he had no doubt that many Bromide papers could be used for the process, he had in his own work certainly found the Illingworth Bromoil paper exceedingly suitable and very easy in all its manipulations. Another paper which had given him satisfaction was the Wellington Thick Smooth Bromide. In any case a paper with some stability about it was desirable. The development of the print, however, was of the utmost importance, and for some reason or another he had found that a Bromide print that had taken a long time to develop was infinitely better than one developed in the normal fashion. Naturally such a print was not pleasing to look at in itself. It was of a greenish hue and had no very strong contrasts. The developer suggested was an Amidol developer diluted to one-fifth or one-sixth its usual strength. The following formula in his hands was a good one :—

Diamadophenol (or Amidol)	25 grains.
Anhydrous-sulphite of Soda	½ oz.
Bromide of Potassium	5 grains.
Water	10 oz.

One part of this solution was used to each four or five parts of water. The exposure of the Bromide paper was on the full side, and development frequently took up to twenty minutes. The great point was, of course, to develop the Bromide paper as far as ever it would go. After development the print was rinsed and fixed in a pure hypo bath, 2 oz. of hypo to 1 pint of water. The print was then washed and dried, and he certainly thought that it was a great advantage to dry at this point in order to toughen the gelatine. His next procedure was to trim the print to the exact dimensions required in the finished picture, and he pointed out that he inked right up to the edge of the print and did not leave any margin. The print was now bleached in any of the well-known bleaching solutions, rinsed for a few moments in water at a temperature of 70 degrees, till all the colour of the bleaching solution had disappeared from the high-lights, hardened by immersion in 10 per cent. solution of formalin for three minutes, then washed again, after which it was fixed in a weak solution of hypo, only 5 per cent. (5 oz. hypo, water to 100 ozs.). The object of this very weak hypo was to fix and clear the bleached print, of course,

BLEACHING AND HARDENING THE PRINT.

keeping the various solutions about the same temperature, namely, 70 degrees. The effect of the hypo would be quickly seen upon the enlargement, and it would remove most of the remaining traces of Bichromate from the image. When this had been effected, the print was again washed and dried, and was then ready at any future time for the final processes.

So far it will be seen that the preparation was exactly the same as for an ordinary Bromoil print.

PREPARATION FOR PIGMENTING.

The next procedure was a prolonged soaking in cold water, and Mr. Stuart was strongly in favour of this course rather than soaking the print in warm water for a shorter time. He had no objection, but, indeed, preferred that the print might be left in a bath of water twenty-four hours before use. By such means every pore of the paper was softened and absorbed water to its greatest extent. Instead of placing the print upon a thick pad of wet blotting paper he preferred to stretch a sheet of thin wet linen, such as an old handkerchief, on the flat glass surface of his Bromoil desk and then lay the print upon it. By this proceeding it is obvious that there is not an excess of water beneath the print, and consequently, when inking up, it is quite possible to work to the very edge of the trimmed margin as suggested previously.

APPLYING THE PIGMENTS.

As for the colours, Mr. Stuart uses a large palette on which he places any of the tints required, and uses Payne's grey, raw sienna, Italian green, foliage green and, indeed, any of the others on the list to give him the effects required. He, however, starts inking up by using some black pigment, such as the Encre Machine, applying this to the deepest shadows, so that they take up some of the colour, and then rapidly works over the whole of the print with the brush, so that the shadows take up just a sensation of this black and hard ink. Then on the top of this substratum he proceeds to use such colours as would be desired to give the finished result. Of course, it may seem at first sight that this starting with black must tend to give a degraded result, but, curiously, on the finished print there does not seem to be the slightest sensation of black, and it would generally be thought that the colours were pure colours. Great care, however, must be taken to have every tone value in proper relation, and Mr. Stuart insists on this if the final

result is in any way to give satisfaction. He contends that it is of comparatively little moment what colour-scheme you adopt, provided the tone values are absolutely correct. The print having been inked up as stated, is placed face upwards, while still wet, on a sheet of flat zinc about 1/16th inch thick. This piece of zinc is supported on a large sheet of card-board. On the top of the wet print is laid without any preparation a dry sheet of thick ivory drawing board or Van Gelder hand-made paper. On the top of this paper is then laid a piece of printer's blanket, and then over all another large sheet of thin cardboard or thick mounting paper, similar in size to the one at the bottom. It will thus be seen that the two sheets of cardboard, being somewhat larger than the printer's blanket, zinc and print, are admirably adapted for starting the whole bundle through the wheels of an ordinary mangling or wringing machine with wooden rollers. The clamp on the top of the mangle is screwed down as tightly as possible, and everything is mangled through together. Mr. Stuart not only passes them through in one direction, but when it is evident that the sheet of zinc has passed the rollers, the handle of the mangle is reversed, and everything is returned to the original position. It will now be found that the result of this pressure has been to take almost every scrap of ink from the surface of the Bromoil print, transferring it to the surface of the transfer paper with an enhanced softness and beauty.

THE TRANSFER.

It will be seen from the foregoing remarks that there is nothing difficult in this process, and the transfer on to the new sheet of paper only takes a few minutes after making the final Bromoil print.

RECAPITULATION. In conclusion, we would briefly recapitulate the essentials.

(1) The negative must be thin, clean and full of detail, with broad effects, but no heavy shadows.

(2) The Bromide paper should be used which is substantial in substance, such as Illingworth Bromoil or Wellington Thick Smooth.

(3) Exposure must be full.

(4) A weak developer one-fifth the usual strength should be applied, and may take twenty minutes to complete.

(5) Rinse print for a few seconds in clean water.

(6) Immerse in a hypo bath free from acid (hypo 2 oz., water 1 pint).

(7) Wash and then dry to harden the gelatine.

(8) Trim print to required size.

(9) Bleach thoroughly in any well-known bleaching solution.

(10) Rinse in water 70°F.

(11) Immerse for three minutes in a 10 per cent. formalin bath.

(12) Wash for five minutes in clean water.

(13) Fix in 5 per cent. hypo bath.

(14) Wash.

(15) Dry.

(16) Give a prolonged soaking in cold water and the print is now ready for inking and finishing.

R. Lincoln Cocks.

VEERE.

Reproduction of oil print from negative taken with the Sinclair "Una" Camera.

CHAPTER XXI.

The Gum Bichromate Process.

J. C. S. MUMMERY,
A.R.I.B.A., F.R.P.S.

J. C. S. MUMMERY,
A.R.I.B.A., F.R.P.S.

Past-President of the Royal Photographic Society.

The process of printing in gum bichromate is one of the most interesting at the command of the amateur and the following brief description may be of assistance in helping the beginner over some of the initial difficulties of the process.

There are several methods of working, and that described is the one adopted by the writer, who has found it simple and satisfactory. It consists of coating a piece of paper with a compound of gum pigment and bichromate of potash, which is sensitive to light when dry ; exposure under a negative and development ; the operations being repeated a second time if necessary to obtain strength or transparency. The materials and apparatus essential to the process are few and simple, and it may be well to consider them in detail as follows :—

PAPER.

Practically any paper may be employed, but such as the O.W. Paper and Arts Co.'s machine-made, Joynson's papers, or hard sized cartridge will work better than the softer varieties, some of which may require sizing to keep the pigment upon the surface and prevent it from staining

GUM SOLUTION.

The gum arabic (gum acacia) should be obtained in lumps or "tears," and the solution made by tying up 4 ozs. of gum in a small piece of linen and suspending the whole in 10 ozs. to 12 ozs. of *cold water* in a wide-necked bottle. The gum will dissolve out in a day or two, and is then ready for use, and the linen with the impurities contained may be thrown away. The gum solution should be corked up ; it will gradually become acid, but so long as the acidity does not proceed so far as to render the gum thin, it will not interfere with the working.

The bichromate of potash should be prepared in a saturated solution.

PIGMENTS.

These may be finely ground powder colours, obtained from an artist's colourman ; in this form they are easily measured, but, of course, moist tube or pan colours may be used.

Lamp and ivory black, red ochre, burnt sienna and many others are suitable, but if browns are required they will be better if made with ivory black and red or burnt sienna, as these mixtures will work with greater ease than the prepared browns.

BRUSHES.

A large camel-hair mop brush and a 4-inch hog-hair "grainer's" softener are required for coating the paper, and some sable or camel-hair water-colour brushes for working upon the print, if this is contemplated.

ACTINOMETER.

As the exposure cannot be properly judged by the appearance of the image, a Sawyer's or Wynne's, or some similar actinometer will be required, and may be worked with pieces or strips of P.O.P.

MULLER AND SLAB.

A piece of ground glass as a slab and a small glass muller are desirable for properly mixing the powder colours, and a palette or other flexible knife.

Other accessories consist of a board upon which to coat the paper, drawing pins, saucers, muslin for filtering, and the ordinary graduates and dishes.

COATING THE PAPER.

To prepare the paper take the following materials :—

Ivory black..	54 grains.
Gum solution	1 oz.
Bichromate of potash solution	1 oz.

(Should lamp black be preferred, 18 grains will be sufficient.)

This will give a warm black, suitable for two or three coatings, and may be taken as a basis for the beginner to work and experiment upon, rather than as a formula for the process.

Should a lighter tinted pigment be used, a greater quantity will be required, and perhaps a slight addition to the gum. Place the powdered pigment upon the glass slab with a portion of the gum, and mix them together with the palette knife, afterwards grinding with the muller for two or three minutes to secure an intimate mixture ; then transfer the mixture to a saucer and add the remainder of the gum and the bichromate solution ; stir well, and filter through a piece of muslin into a graduate and turn out into a clean saucer. The mixture is now ready for coating, and the sheet of paper, which should be somewhat larger than the negative to be printed, is placed upon a sheet of absorbent paper on the board and secured with drawing pins at the four corners.

Now, taking the mop brush, stir the pigment mixture thoroughly, and striking off all superfluous mixture on the edge of the saucer, proceed to lay a thin wash over the paper with long horizontal strokes, afterwards crossing this with vertical strokes, and finishing off with the dry softener, by a succession of horizontal and then vertical strokes, keeping the brush in a vertical position and using only the end of the hairs.

The whole operation should not occupy more than about 50 seconds, and the resulting tint on the paper should be level and even; the small ridges left by the hairs of the softener will level down as the paper hardens, which it will do in about half an hour, when it may be desiccated upon the plate rack over a kitchener or in a cool oven, and stored in a pressure frame or calcium tube.

It is, of course, sensitive to light when dry. Paper prepared in this manner will be workable for some weeks if kept in a calcium tube, but will be found to work more freely if used within a few days. The surface should be slightly glossy, and an unexposed piece, if

soaked in water, should lose the whole of its coating in about 30 minutes or so; this property will indicate the condition of the paper at this stage.

The brushes must be carefully washed after use, as, if allowed to harden, they will be ruined.

After printing, developing and drying, a second or further coating may be applied in a similar manner, or local coatings may be applied to areas it is desired to strengthen, without adding to other portions of the print.

PRINTING.

This may be performed in an ordinary printing frame, or, better still, upon a small drawing board, having two small fillets of wood screwed to the face at right angles to each other; the coated paper is then laid face upwards upon the board, one edge touching the top fillet, and is slid sideways until another edge touches the side fillet; the negative is then adjusted, film downwards in the same manner, and a piece of heavy glass laid upon the top to ensure good contact; by this means the negative may at any time be replaced in correct register for a second or third printing.

The negative best suited to the process is one thin, clear and fully exposed, and the paper prepared as described will be somewhat more rapid than P.O.P. It should be fully printed with the same exposure which would make a piece, say, of Paget P.O.P. look as one would desire it.

There is little visible image, and the actinometer must therefore be employed to secure correct exposure, and care should always be taken to avoid over-exposure, as the image then becomes dull and buried.

When properly exposed, the image (unless the coating is very dark) will be clearly visible by transmitted light; and if the print is not developed at once it must be kept absolutely dry, or insolubility will ensue. A good light is best for printing, but direct sunshine should be avoided.

DEVELOPMENT.

Here a variety of methods are available, but that recommended is by a spray, and will require a dish of cold water, a spray diffuser, as sold by artists' colourmen for fixing drawings, a small bottle for water and a piece of glass.

The print to be developed is placed face upwards in the dish of water when, if the gum is in proper condition, the dark parts of the visible image will become light and the light parts dark. As soon as the print is wet, withdraw it from the water and place it upon the sheet of glass, adjusting this at a convenient angle, almost vertically above the dish ; then with the bottle full of water proceed to blow a fine spray over the surface of the print, say at about one foot distance. The operation should be begun on what will be the lightest part of the print, usually the sky, and carried through from this ; the fine spray will loosen the pigment and will run down the face of the print bearing the soluble pigment with it ; care must, of course, be taken not to wash away what it is desired to retain, and it is well to have a print at hand to work by and to know exactly what is required.

If the print has been exposed correctly the surface is extremely delicate, and the spray will remove the pigment easily and readily, without exertion, being advanced to or withdrawn from the print as a strong or gentle abrasion is required. The operation may be carried out with less exertion, especially in the case of large prints, by the use of a " Fletcher's foot bellows " connected to the spray with a length of rubber tubing ; a No. 3 size is suitable and costs about 26 shillings.

A 12×10 print should develop under the spray in from 5 to 10 minutes, and, as the surface gradually dries, sharp high-lights may be taken, and other modifications made with a brush or other tool.

The print is best left to dry upon the glass in a nearly vertical position, and if satisfactory may be considered finished ; but, if further modification, more transparency or greater strength be required, a further coating, printing and development may be given as described.

Modifications in the second coating will suggest themselves to the worker, such for instance as a coating weak in pigment with a long exposure for breaking down strong contrasts ; or again, a coating rich in pigment and a short exposure for strengthening a flat print, or perhaps the introduction of another colour.

Other methods of development may be adopted. The image may be washed up under a fine gentle spray from a tap, or pouring the water from a jug on to the margin of the glass and allowing it to run over the print where required ; or automatic development may

be adopted, in which case the print may be left face downwards in the dish of cold water to develop itself; this it should do, if all be well, in from half to one and a quarter hours; then when sufficient general development has taken place, it may be removed on to a glass plate and any high-lights picked out with a brush, afterwards drying the print in the dark, re-wetting it and working upon it with brushes. The exposure in this method must be delicately adjusted to allow of the automatically developed print drying without running off the paper or becoming flat, and the method is much better adapted for a thicker and stronger single coating, say, 60 grains ivory black to 1 oz. of a 45% to 50% gum solution and 1 oz. of bichromate solution. When the print is dry, if the bichromate stain is objectionable, it may be removed by soaking in a 5% solution of alum or bisulphite of soda, and afterwards rinsing in cold water; and when dry the print may, if desired, be varnished with gum or celluloid varnish.

In conclusion, it may be noted that the process is in itself extremely simple, and requires only a little patience, delicate handling and the knowledge gained from observation and trial to ensure a satisfactory working. The bare description is necessarily tedious and uninteresting, and differs from the description of most other printing processes, inasmuch as it includes the manufacture of the printing paper; however, when reasonable facility has been acquired, the personal nature of the operations and results give an interest unequalled in the working of any other process.

J. C. S. MUMMERY.

CHAPTER XXII.

Autochrome Manipulations.

The introduction of the Autochrome plate puts it within the power of the amateur photographer to record the colour as well as the outline, light and shade of his subject, and that with very little more trouble than in making an ordinary negative. The instructions for the use of Autochrome plates have been modified by Messrs. Lumière since they were first issued, and a host of other formulæ and instructions have been put forward by different workers. Most of these I have tried, only to come to the conclusion that the best results are most certainly and most easily obtained by following closely the directions given by the makers. What follows, therefore, is based on Messrs. Lumière's instructions, modified only where needed to allow of the use of chemicals obtainable of any British chemist.

The complete outfit for Autochrome photography, besides the camera and other things used in ordinary photography, consists of a supply of the plates and the few chemicals, a special colour screen and a holder to fit it to the lens, some black cards which are supplied with the plates, a dish and a safe light. Messrs. Lumiere supply " Virida " papers, which may be enclosed between glasses and used in the lamp ; and the use of these " safe-lights " greatly simplifies the development of uncertain exposures.

It is best before exposing a plate to make up the various solutions required. The list is a simple one, the solutions keep very well, and although distilled water is sometimes recommended, it is not in the least necessary. The pyro (Bath A) will keep for a month at least, and the other (Bath B) keeps almost indefinitely.

*Although the makers have introduced a metol-hydrokinone developer, rendered alkaline with ammonia, formula for which is given below, I much prefer the original formula for development with pyro-ammonia, using as a preservative of the pyro solution

* Those who prefer the quinomet developer, and are not susceptible to metol poisoning, can either buy it ready prepared or mix it up from the formulæ given at the end.

a trace of sodium bisulphite lye. This developer does not affect the skin as the other (Quinomet) does. The developer I use invariably now is as follows :—

BATH A.

	Water	10 ounces.
	Sodium bisulphite lye	5 drops.
or	Potassium metabisulphite	5 grains.
	Pyro	160 grains.

BATH B.

Liquor ammonia ·880°	400 minims.
Potassium bromide	135 grains.
Water	8 ounces.

For development, half an ounce of A is diluted with five ounces of water, and, immediately before use, half an ounce of B is added.

Although a light *may* be used for development, this is only possible from the fact that the developer seems to rob the plate of much of its colour sensitiveness. As far as filling slides and commencing development are concerned, the work should be done in total darkness. This is not difficult. All should be got ready beforehand ; the dark slides open and dusted out ; the black cards black side upwards, where the hand can be put upon them in a moment ; the box of plates with its outer paper removed ; and a clean soft piece of washleather.

Two things call for note in filling the slides. The glass side of each plate must be carefully cleaned by breathing on it and rubbing it with the washleather, and on no account must the film side be injured. A slight scratch on it will show in the finished picture as a bright green spot. The plate after cleaning has a black card put upon it, with the black side next the film, and is put into the dark slide, not forgetting that it is the glass side that must come next the shutter. The card is used to protect the film while it is in the slide.

As the glass side faces the lens, the sensitive film is further away from the lens than when an ordinary plate is in the dark slide. In order that the picture may be sharply focussed, therefore, there must be some compensation for this. The colour screen, if placed, after focussing, between the lens and the plate, lengthens the focus of the lens sufficiently to allow for the plate being turned. Or the ground glass may be turned ground side away from the lens, which, as there is not much difference between the thickness of the glass

of an Autochrome plate and of the ground glass, will serve the same purpose. The writer does not adopt either expedient, but merely racks *in* the back of the camera, after focussing, about the thickness of a plate.

The special yellow screen supplied by Messrs. Lumière must be used, or the colours will be incorrect. If no screen at all is employed, nearly all the colours will have a violet shade. If in spite of the screen this violet tint makes its appearance, there is a leakage of light into the camera.

The exposure in this, as in all photography, is the crux. Unless a meter is employed, there will be a great waste of plates. In a good light it is safe to assume that the Autochrome plate, with its yellow screen, has a speed of 2 Watkins, or of *f*/14 Wynne. In winter, and generally where the light is poor, say, wherever the exposure with *f*/8 according to the meter would be more than a minute, the exposure must be considerably increased. It may safely be doubled at the least. Watkins supplies a special dial for his meter to make this correction. The writer has not found any necessity for the increase when the light is good, and the exposure is merely made a long one by using a small stop.

As very little light is permissible for development, it is well to clear the bench of everything except what is wanted for the process. These are a dish and a card to cover it, a watch or dark-room clock, and two graduated measures. Into one measure is poured the developer and into the other a similar quantity of the "C," reversing, solution. The formula for this bath will be found with Messrs. Lumière's instructions at the end of the article.

The time of development for a correctly exposed plate is said to be 2½ minutes, but this is influenced by the temperature of the developer. In my own practice, I use a "Watkins' Thermometer for Autochromes." This is put into the developer for half a minute and indicates directly the time during which development should be continued. The dish can be kept covered all the time; but there is no harm in glancing at the plate after it has been in the developer for at least a minute, if the dark-room lantern is provided with a "safe light."

Messrs. Lumière have given instructions for the control of development, which are recapitulated at the end of this article; but these have certainly not given me, at any time, results comparable

with those that are to be got by correct exposure followed by development for a standard time.

After a few plates have been developed the photographer will find that he can form a very fair idea of the completion of the operation by the appearance of the surface of the plate as it lies in the dish. Nothing is gained by looking through it, and it must not be picked up for the purpose. If the surface is creamy white, with only the very brightest parts of the subject showing as dark patches, the plate is under-exposed. If it is black all over, except perhaps in the deepest shadows, it is over-exposed. If it looks very much as an ordinary plate looks when it is under-exposed and fully developed, the exposure has been about correct. In the properly exposed, properly developed Autochrome, almost every part of the surface will have darkened to some extent, but only the very brightest parts will be perfectly black.

Although the treatment above described will not cause the plate to be perceptibly fogged, it must not be forgotten that it remains sensitive even to red light until after development. The total exposure to the lamp for examination purposes must not exceed three or four seconds, or the colours will be weakened. If the plate is held up to the light and looked through, there is risk of the colours being made too red.

After development the plate, still in the dark, is rinsed for half a minute, and is then flooded with the "C" solution and the dish rocked. After it has been in this bath for two minutes, it may be taken out into daylight and examined. If it is exposed to daylight sooner than this, there is a risk of transparent spots being formed. By this time the reversing solution will have done its work, the just developed negative image will have been dissolved away, leaving its counterpart, a positive image in creamy white silver bromide. On holding the plate up to the light at this stage, the colours will be seen, but they will not be as brilliant as they afterwards become. When the "C" solution appears to have no further effect upon the plate, which will be the case in less than three minutes after its application, it is poured away, the plate is rinsed for a few seconds, and is then flooded with an ordinary amidol developer. A convenient strength is

Amidol	2½ grains.
Sodium sulphite	15 grains.
Water	1 ounce.

This should be freshly mixed. If quinomet is used for the first development, the solution after use may be kept and used for this second development, instead of the amidol, but the pyro-ammonia developer is not satisfactory for this purpose. This second development can be performed very effectively with rodinal 1 part, water 20 parts.

The object of this second development is to darken the creamy white silver bromide, by reducing it to a metallic state. Daylight is important at this stage; and if the darkening has to be done at night, the plate should be held up while three inches of magnesium ribbon are burned at about six inches distance. Three or four minutes must be allowed for this action of the developer, which must be carried on for some time after the high-lights are completely darkened.

The plate is then washed for about five minutes and immediately placed to dry; fixing is unnecessary unless the plate has been intensified.

Such is the development of the autochrome plate and it will be found, providing the exposure is correct, and the development has been properly carried out, that when viewing the plate by transmitted light, it appears a brilliant transparency with the objects rendered in their true natural colours. All that remains to be done, when the plate is thoroughly dry, is to coat it with a special varnish, composed of 1 ounce of gum dammar dissolved in 10 ounces of pure benzol. An alternative varnish is one consisting of celluloid dissolved in amyl-acetate; both of these varnishes are better bought ready-made, as they are messy to prepare and filter.

Varnishing adds greatly to the brilliancy and quality of the plates, and at the same time favours their permanence. Under no circumstances should ordinary varnish be used, as this would damage the colours.

Should the plate when varnished appear too dark, and all the colours degraded apparently with black, it is due either to under-exposure or under-development, but in all probability the former. If the plate is under-exposed, sufficient of the silver is not reduced to a metallic state in the first development, and consequently too much is left on the plate to form the positive image, which is darkened in the second development. On the other hand, in cases of over-exposure the image is too transparent and the colours will lack brilliancy, and in such cases the result is considerably improved by

intensification. The plate may be intensified either immediately after the second development or, if preferred, at any time after it has been dried, providing the varnish has not been applied.

Should it be desired to intensify the image in order to increase the brilliancy, the following solutions are necessary, and should be prepared in advance :—

BATH E. OXIDIZING SOLUTION.

Solution "C" (see page 177)	3 drams.
Water	1 pint.

BATH F. INTENSIFIER.

Citric acid	26 grains.
Water	20 ounces.
Pyro	26 grains.

BATH G. INTENSIFIER.

Silver nitrate	50 grains.
Water	2 ounces.

BATH H. CLEARING SOLUTION.

Potassium permanganate	½ dram.
Water	80 ounces.

BATH I. FIXING BATH.

Hypo	6 ounces.
Liquid sodium bisulphite	2 ,,
Water	40 ,,

Liquid sodium bisulphite is easily obtainable in London, but should the photographer find himself unable to get this compound, saturated solution of potassium metabisulphite may be used instead.

To Intensify. The plate is immersed in solution E, given above, for 10 or 15 seconds. This oxidizes any trace of developer remaining in the film and allows of proper intensification. Should this oxidizing solution be left on for too long a time the colours will be weakened, and in cases of decided under-exposure this is an advantage, and the time in "E" may be increased to half a minute or even longer. The solutions labelled "F" and "G" form the intensifier, and two drams of "F" are added to three ounces of "G" immediately before use. The plate as it comes from the oxidizing

solution is rinsed for a few seconds in running water, and the intensifier poured over it. Action is rapid and the intensifier will be found to strengthen the colours considerably.

If the Autochromes are wanted for lantern slides, the intensification must be of the slightest character, or they will be made too dense. If they are to be seen in the hand the action may be carried further. The intensifier discolours in a minute or two, but may be used until fine black particles are discernible in it, when it must be thrown away. If the intensification by that time has not gone far enough, the plates may be rinsed, immersed in the "E" solution again, and the process repeated with fresh intensifier; but such occasions are very rare. As a general rule, the intensifier will be found to do all that is wanted by the time it begins to discolour. As intensification is pushed the plate will be stained yellow, but this may be disregarded as the stain disappears in the after operations.

After intensification the Autochrome must be rinsed for at least half a minute, more rather than less, and is then placed in plain permanganate solution "H" for a minute. It is again rinsed for a full half-minute, and slipped into the hypo "I," in which it will be completely fixed in a minute. Five minutes' washing under the tap will complete the operations, and give us the finished Autochrome, needing only to be varnished and bound up with a protective cover-glass. It is dried in a rack; the coating being thin, the operation only takes a few minutes. No heat must be used, and the plate must not be placed where it may stand with its lower edge in a pool of water that has drained from it. Should the colours weaken in the hypo, the blackening in the second development was not done in a bright enough light or was not carried far enough, or else the washing before and particularly after the application of the "H" solution was not sufficient.

To varnish an Autochrome, the dammar varnish is merely flowed over the surface, and poured off in the ordinary way. Again no heat must be used, and the benzine being highly inflammable, the operation must not be conducted near a naked flame. Although the plate appears to dry almost instantly, the varnish actually remains tacky for an hour or two, and the autochrome should be put on one side until this time has elapsed.

One dish may be used throughout the operations, and although it may get stained at first, the after operations should remove the

stains from the dish as well as from the plate. In the same way, stains on the fingers can be removed by the " H " solution followed by the acid hypo, or in bad cases by the " C " solution. It is better not to get stained fingers, and if a glass dish is used, there is no need to pick the plate up at all, or a celluloid clip may be employed, and this is particularly useful when intensifying the plate.

The actual operations will be seen to be very simple, consisting merely of development, reversal and redevelopment followed by washing and drying. The film is so thin, that none of these take more than five minutes, and even the final washing is complete in this time. As the plates dry very quickly, it is therefore easy to get a complete finished dry Autochrome in about half an hour. The intensification and other processes should only be employed, when an error in exposure has made them necessary ; correct exposure and the standard development will yield as brilliant and vigorous a picture as anyone can want without them.

HOW TO SECURE INSTANTANEOUS EXPOSURES ON AUTOCHROME AND OMNICOLOUR PLATES.

Many attempts have been made to secure instantaneous results on Autochrome plates but the methods employed have been uncertain in result and the procedure beyond the abilities of the average worker.

Thanks, however, to the researches of Monsieur Ch. Simmen and the skill of Monsieur F. Monpillard, a process is now available enabling workers possessing a dark-room and ordinary manipulative skill to so increase the speed of their colour plates, either Autochrome or Omnicolour, that in good light fully exposed results may be obtained with instantaneous exposures.

The means employed are :—

(1) Bathing the plate in a special sensitizing bath.

(2) The use of a taking screen adapted to the plate so treated.

Beyond the ordinary articles used it will be necessary to provide

Alcohol at 90° (ethyl).

A drying box and some calcium chloride.

A whirler and some blotting paper.

The drying box can easily be improvised. Take any well-made box and make it light-light, and as air-tight as possible. Arrange the interior so that the plates may be easily disposed for drying, either by leaning against the sides of the box or in a rack leaving as much space as possible between the plates. Allow room for the insertion of the box containing the calcium chloride.

INSTRUCTIONS.

Take 3½ ozs. alcohol 90° and add to it 10½ ozs. of distilled water. Label "Alcohol solution 22·5°."

In ordinary practice it is preferable to sensitize two plates at a time. For two quarter-plates use a 7×5 dish and 3½ ozs. of solution.

To 4 ozs. of the alcohol solution add ½ oz. of the ammonia solution B and ½ oz. of the sensitizing solution A as supplied.

From this onward all operations are preferably performed in complete darkness; the Virida light as used for Autochromes is, however, permissible if the illumination be very feeble and all operations carried out at the greatest distance possible from the light.

Place the first two plates in the solution and, with occasional rocking, allow them to remain immersed for 3 to 3½ minutes. At the expiration of this time withdraw the plates and stand on end on some clean blotting paper to drain.

Then put two more plates in the solution, allowing them to remain in for four minutes.

If the bath be used for sensitizing more than four plates, about one-third of the quantity should be thrown away and replaced by the same quantity of fresh bath. If, after use, it is desired to keep the bath for further use, it should be stored in a well-stoppered bottle in the dark, as otherwise it will lose its colour and activity.

While the second pair of plates are immersed, the first, which have been draining, can be placed in the whirler—given a few seconds whirling, then placed in the drying box. The whirler may be dispensed with if the plates be shaken violently and all drops removed from the back of the plate, but we advise its use, as the minimum quantity of solution is retained by the plate and drying is consequently more rapid. Once all plates are stood in the drying box, the box containing the calcium chloride should be introduced, the lid removed and the drying box closed.

Time of drying will depend on the state of the calcium, the number of plates, etc., but a good plan is to sensitize at night and remove plates in the morning. The cards found in contact with the plates should be stored in a dry place in order that they may be in the best condition for again placing in contact with the plates when loading the dark slides.

Plates so sensitized will retain their speed for at least a month, after which time they will gradually become slower.

Before exposure, the glass side of the plates should be thoroughly cleaned.

Exposures may be calculated on a basis of one-fifth those necessary for a normal Autochrome.

With a focal plane shutter and a lens working at $f/4{\cdot}5$, well-lit subjects in sunlight will be fully exposed in 1/25th of a second.

Development is carried out as usual (Quinomet being preferable to Pyro). The Virida safe light is used but should not be approached till the plate has been in the developer some 30 to 40 seconds. The plate will at first appear darker than usual owing to the colour imparted by the sensitizer, but gradually resumes its normal appearance.

All other operations are performed as usual.

Screens are supplied for use with daylight, or flash powder at the same price.

AUTOCHROME DIFFICULTIES.

Green spots in the finished plate. These are caused through water penetrating the waterproof coating on the surface of the starch grains owing to its perforation, usually by particles of dust or rubbing in the plate holder. Mr. Essenhigh Cooke recommends cutting out the defect with a sharp knife and then filling in the blank clear glass with Chinese white tinted with colour to match the surrounding objects.

Bluish or too dark results. These are due to under-exposure.

Pinkish and too light results are due to over-exposure or over-development in the first solution. To get the true effect of a lady in a white dress or a sunlit snow scene it is often necessary to develop only for 30 seconds or 1 minute. The whole of the silver must not be reduced when developing the first or negative image, for in this case the permanganate bath leaves nothing for the second development.

Some Supplementary Suggestions, etc., by Messrs. Lumière.

DEVELOPMENT (CONCENTRATED QUINOMET) (*a*).

Water	1000 c.c. or 35 ozs.
Quinomet (*b*)	15 grammes or ½ oz.
Anhydrous sodium sulphite ..	100 grammes or 3½ ozs.
* Ammonia ·920 (22° Baumé) ..	32 c.c. or 9 drams.
Potassium bromide	6 grammes or 90 grains.

BATH C. REVERSAL.

Water	1000 c.c. or 35 ozs.
Potassium permanganate	2 grammes or 30 grains.
Sulphuric acid	10 c.c. or 3 drams.

(*a*) This concentrated developer may be purchased in bottles of 17 ozs., 9 ozs., 4½ ozs. For use it is diluted with four times the quantity of water (1 oz. concentrated solution to 4 ozs. water).

(*b*) The Quinomet should be dissolved in warm water (about 100°), the sulphite added and then the ammonia.

* Ammonia ·920 may be prepared by adding 1 oz. of water to 2 ozs. ammonia ·880, the strength which is usually sold in Great Britain.

METHOD OF FIRST DEVELOPMENT

In cases of uncertain exposure.

The automatic development for a fixed time (2½ minutes) is applicable only when exposure is known to be practically correct; if it be used invariably, regardless of exposure, the resulting image is liable to be thin and without detail, in the case of over-exposure, or dense and insufficiently developed in the case of under-exposure.

We have, therefore, devised the following method, which, while less simple than the former, indicates (according to the time elapsing between immersion of the plate in the developer and appearance of outlines of image), the length of development necessary to obtain a good result.

The dark-room lamp should be fitted with Lumière "Virida" papers.

FOR THE DEVELOPMENT OF ONE HALF-PLATE.

(1) Put in one measure glass 15 c.c. (½ oz.) and in another 45 c.c. (1½ ozs.) of the concentrated quinomet developer.

(2) Put in the developing dish

Water.....	80 c.c. or 2½ ozs.	}	Temperature
Concentrated developer ..	5 ,, 85 mins.	}	60°.

Immerse the plate in this solution and count the number of seconds elapsing before the first outlines of the image appear, disregarding the sky. Immediately the outlines are discernible, pour into the dish either 15 c.c. (½ oz.) or 45 c.c. (1½ ozs.), whichever may be necessary according to the following table, continuing to count the seconds :—

Appearance of outlines of image (disregarding sky) after immersion.	Quantity of developer to add on appearance of first outlines.	Total duration of development (immersion of plate).	
Seconds.		Minutes.	Seconds.
12 to 14	15 c.c. (½ oz.)	1	14
15 ,, 17	do. do.	1	45
18 ,, 21	do. do.	2	15
22 ,, 27	do. do.	3	
28 ,, 33	do. do.	3	30
34 ,, 39	do. do.	4	30
Extreme under-exposure. 40 to 47	45 c.c. (1½ ozs.)	3	
Extreme under-exposure. Above 47	45 c.c. (1½ ozs.)	4	

For a plate 4¼×3¼ use half the above quantities. The succeeding operations : reversal, second development, and, if necessary, intensification, proceed as usual.

The makers supply the above table printed on transparent paper. For reference during development it may be affixed to the window of the lamp.

Success in Lantern Slide Making.

It is doubtful whether a photograph can give as much pleasure in any other way as by means of a transparency shown in the lantern. But the transparency, or lantern slide as it is termed, must be good ; and although a good slide is easy to make, yet an experience of many years in judging lantern slide competitions promoted by first-class societies, leads us to believe that the majority of workers do not understand what are the characteristics of the perfect slide. The aim of this article is to show beginners what they must strive after, and to help those who have failed to attain proficiency in this delightful branch of photography.

THE LANTERN SLIDE AND ITS CHARACTERISTICS.

A lantern slide is simply a print on glass instead of on paper, and the process is akin to the making of bromide prints, using prepared sensitive glass plates instead of the prepared bromide paper. The standard size plate used in the United Kingdom is $3\frac{1}{4} \times 3\frac{1}{4}$ inches, and consequently, when slides are made by contact—like bromide prints—it is only possible to reproduce a portion of the negative, and therefore, when desirous of including the whole of the picture from negatives which exceed the dimensions of the lantern plate, we must use a reduction process, as we shall show later. Whichever method we employ to make our slide, quite apart from the question of colour, we must ensure that :—

(1) The slide shall have a long range of gradation.

(2) There must be no portion of the slide which fails to transmit light.

(3) Only on rare occasions shall there be clear glass on the slide.

Characteristics 1 and 2 can be judged by looking through the slide, preferably by setting it at an angle with its lower edge touching a sheet of white paper turned towards a window or a lamp, so that the white light is reflected by the paper through the slide. Under such conditions the slide should look harmonious and free from harshness and without opaque shadows. The slide may then be laid with its surface on the white paper and the high-lights should show a tint of greyness on the image, and only objects of exceptional brilliancy must be rendered as clear glass.

ON LANTERN PLATES.

While we can make a transparency on an ordinary negative plate, yet this is hardly suitable, because it is so rapid that exposure is a difficult matter. All the plate makers make Lantern Plates of the standard $3\frac{1}{4} \times 3\frac{1}{4}$ inches, and generally two speeds are issued, one known as "slow" which will give a range of colour from red to black, and another called "rapid," which is more suitable for black tones. We, ourselves, always use one of the "slow" brands, even for reduction purposes, because of the facility they afford for getting warm colours. Still, this is a point of personal feeling and equally good slides can be made from the plates of all the leading makers. As in negative making, we prefer our lantern plates to be "backed," for undoubtedly backed plates ensure finer results, and the extra cost is trifling.

SLIDES BY CONTACT.

We will suppose that we have purchased a box of lantern plates and propose to make slides from our negatives. If we use a "slow" brand of plates we may have plenty of light in our dark-room, and a yellow screen such as the Wratten "O O" will be found a boon. Exact distances should be measured off from the source of light to the position occupied by the printing frame and pencil lines made on a shelf or bench, providing either is handy, or even on the wall will answer admirably. It might be advisable to mark positions at $8\frac{1}{2}$ inches, 12 inches, 17 inches and 24 inches, using the 12-inch position as the standard one and rarely placing the frame in any other. Each of these distances doubles the necessary exposure of its predecessor, thus :—

Distance	$8\frac{1}{2}$ inches	12 inches	17 inches	24 inches
Relative exposure	30 seconds	60 seconds	2 minutes	4 minutes.

Dense negatives will, therefore, be placed nearest the light and very thin ones furthest away.

LANTERN SLIDE PRINTING FRAMES.

Although an ordinary printing frame will do to make a slide, it is not so convenient as the special frames supplied, because light is apt to creep in at the edges of the lantern plate and slightly fog the margins of the pictures. For those who cannot conveniently procure a special frame we should advise that the ends of their ordinary printing frame are filled up, so that light cannot strike in and affect the edges of the plate. A typical and simple form of the Lantern Slide Printing Frame is that which is suitable for any size negative up to

$8\frac{1}{2} \times 6\frac{1}{2}$. It consists of a flat board covered with cloth, against which the surface of the negative is held by two rubber-covered brass springs. A hole in the centre of the board which holds the lantern plate allows of any desired portion of the negative being adjusted in position, after which the lantern plate is inserted with its film in contact with the negative, and a solid back is dropped into the opening and held with a spring. The exposure is then made by holding the frame at the distance selected for the requisite time.

A LANTERN SLIDE DEVELOPER.

For our own use we like warm-toned slides, and these are generally in favour at the present day. When we suggest making up 4 bottles of solution, we shall doubtless frighten some of our readers who fancy their shelves are already overburdened, but we would point out the solutions are concentrated, and will keep good for a long time. For those who want the best results the making up, perhaps once a year, of these four simple solutions is not a very serious matter. The favoured formula is one used by Mr. F. P. Cembrano, the quality of whose slides has never been surpassed.

No. 1. Label bottle 10% Pyro.

Pyrogallic acid	1 ounce.
Sulphite of soda	4 ounces.
Citric acid	1 dram.
Water to	10 ounces.

No. 2. Label bottle 10% Bromide.

Potassium bromide	1 ounce.
Water to	10 ounces.

No. 3. Label bottle Ammonium Carbonate 10%.

Ammonium carbonate (clear crystals)	1 ounce.
Water to	10 ounces.

No. 4. Label bottle Potash Hydrate 10%.

Potash hydrate	1 ounce.
Water to	10 ounces.

Once made up these solutions will keep good for a year, and very little is used for each plate.

EXPOSURE.

The exposure when using such plates as Paget Slow Lantern will be about 30 seconds with the frame at a distance of 12 inches from a 16 c.p. electric glow lamp. An initial trial may be made to test the light and to form a standard for future comparison, and for this

purpose we make trial exposures by uncovering the plate in strips. A piece of card over the surface of the printing frame will suffice and this should be successively withdrawn, so that a quarter of the negative is first exposed for 40 seconds, then, withdrawing the card another quarter, an exposure is given for 20 seconds, a third quarter has an exposure of 10 seconds, and now removing the card altogether, a final exposure is given also of 10 seconds. Our lantern plate will now be exposed in four strips which have had exposures of 10, 20, 40 and 80 seconds respectively, and this when developed will show which exposure gives the best result.

DEVELOPMENT.

The time taken to develop gives an excellent clue as to whether the exposure is correct, and we recommend that the exposure should be so arranged that the development always takes about the same time.

Before proceeding to develop compound the developer as follows :

To each ounce of water add—

30 minims 10% Pyro.
30 ,, 10% Bromide.
60 ,, 10% Carbonate ammonium.
50 ,, 10% Potassium hydrate.

The image should appear in 20 seconds and development should be completed in 80 or 90 seconds. These times are important, for if the slide is not ready in the time mentioned the result will be hard and unsatisfactory, and will show exposure has been insufficient. On the other hand, if the image appears before the time mentioned, the result will probably show over-exposure and the time must be reduced.

After rinsing quickly we fix in a bath of—

Hyposulphite of Soda, 5 ozs.,
Metabisulphite of Soda or Potash, 1 oz.,
Water to 20 ounces.

Some makers object to the Metabisulphite because it has perhaps a tendency to make the colour somewhat cooler, but we have never found any disadvantage from its use, while it decidedly hardens the film and stops development.

WASHING.

The plate after fixing should be washed for 20 or 30 minutes in running water—preferably in a tank in which the water is syphoned out from the bottom. It should then be carefully wiped over the surface with a moist plug of cotton wool, or failing this the ball of the finger,

the water playing on the surface at the same time. This is to remove lime salts or other deposits frequently found in tap water.

HARDENING THE FILM.

We strongly suggest hardening the film with a solution of formalin before drying, if only to preserve the slide, for very often slides are ruined in the lantern the first time of using should the film be not thoroughly hard and dry. For this purpose formalin will be found most useful, for it not only preserves the film, but enables the plate to be dried quickly by heat, thus lessening the chance of it being spoilt by dust. The plate is, therefore, after washing placed for 10 minutes in a solution of

Formalin .. .. 1 ounce.
Water .. .. 9 ounces.

after which it is washed again for five minutes and then dried.

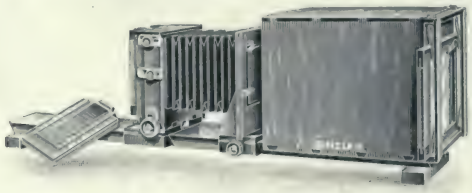
VARNISHING.

To further preserve the slide it should be varnished; but we do not care for the usual transparency varnishes, which are slow dryers and frequently accumulate dust on the surface and spoil the slide in the lantern. The best varnish is a celluloid one, such as Hartley's, and this sinks into the surface of the film, dries hard, and is waterproof. To varnish the plate, it should be held on the tips of the fingers of the left hand, or better still, supported by an India-rubber pneumatic plate-holder. A pool of varnish is then poured on to the plate and the holder is gently tilted, so that the varnish successively runs to each corner, finishing with the right-hand corner nearest the operator, who then allows the surplus to flow off into the bottle which is held to receive it. When varnishing do not try and put on only just enough varnish; pour on plenty, for if the plate is held steadily it will not run over the edges, and the surplus can always be poured from the corner of the plate into the bottle. The plate being varnished, set it in such a rack as the Sinclair Ideal Rack, so that any surplus varnish drips from one corner on to a sheet of paper placed under the rack. After the plate has drained for about 5 minutes there is generally a drop of varnish on the lower corner of the plate, and this may be gently removed with a clean cloth, touching the extreme edge.

THE SINCLAIR DRAINING RACK.

LANTERN SLIDES BY REDUCTION.

While lantern slides can always be made by contact from portions of negatives, still the pictorial worker who has composed his picture on the plate, wants the whole of it reproduced on the slide, and for doing this we must use a reducing camera. In our own practice the majority of our negatives are quarter-plates, taken with a hand camera, but as we always try and get the best composition in these small plates, it is very rare for us to use the contact method. To reduce, we have to re-photograph the negative on to a lantern plate, and this necessitates our placing the negative in such a position that light can pass through it. This may be done by fixing the negative in the window of a room and copying it by means of a stand camera with sufficient extension, but obviously such a course is a slow and trying one, because the negative, lens and plate should be parallel with one another and in the same optical axis. We use a lantern slide camera, as shown in the illustration. This consists of a baseboard on which the camera, which has a bellows extension of 18 inches, can be easily moved backwards and forwards, and the back of the camera has a rack and pinion for fine focussing. There is also a swing back, to correct any lines which may



THE SINCLAIR LANTERN SLIDE CAMERA.

be out of the vertical in the negative from which the slide is being made. The front of the camera takes our lens, which may conveniently be of 5 or 6 inch focus, and this lens projects into the fixed box at one end of the base. This box is fitted with an adjustable carrier, which will take ½-plates or any smaller size, by means of inner frames, and the carrier, being movable vertically, horizontally or diagonally, permits of the horizon line being placed parallel with the edge of the lantern slide, even when it is out of position in the negative. The dark slide is a single one. When using such a reducing camera we must point it towards the sky, taking care that an imaginary line drawn from the lens through the negative would, if continued, not be interfered with by houses or trees. This is not always easy in town

houses, unless we have a room near the top of the building at our disposal, and, should we not have such a position at our command, the camera may be kept horizontal and pointing towards a window in which there is a piece of ground glass, somewhat larger than the negative, and about 3 inches from it. The ground glass should be of the fine or focussing screen variety, and may with advantage be slightly oiled so that, more light passing through it, the exposure may be reduced.

The time to expose may seem a difficult problem, but after a few trials, drawing the shutter of the dark slide as suggested when making contact slides, we shall find the proper time. Of course, the fact that daylight is constantly varying may cause trouble, and our method when we used daylight was to always test the light with a Watkins Meter held in the position occupied by the negative, or rather just by its side, for we used to expose the meter and camera simultaneously. Supposing we found that an exposure of two minutes was required on a day that the meter took 30 seconds to darken, we are fairly safe to assume that when the meter took 15 seconds our exposure should be one minute, and if the meter required one minute then our exposure should be four minutes. The times mentioned are, of course, only suggestive of the principle, and are not the identical times, which we have now forgotten, and would, in any case, not do for the negatives of others. We may say that we prefer the Watkins to the Wynne Meter for this purpose, because the Watkins paper taking about twice the time to darken, there is less likelihood of error. For many workers, business engagements prevent other than night work, and in these cases the reducing camera must be used in connection with artificial light. The best plan then is to place the reducing camera on a table and to have a condenser, such as is used in enlarging lanterns, and of sufficient size, arranged on a block so that it is parallel with the surface of the negative, and a sheet of finely ground glass is placed between the condenser and the illuminant. The stronger the light the better, and electricity in the form of a Nernst lamp, or small arc lamp, is desirable, but failing this an oxy-hydrogen lantern jet does admirably, after which we should suggest acetylene. The objection to weak light, such as that given by oil lamps, is the long exposure required. To give some idea of the exposures necessary when working in this way, we may say that when reducing from ¼-plate to lantern size, using a No. 3 Kama lamp, 220 volts, *f*/8 stop and 6-inch condenser with

ground glass interposed between the light and condenser, and using a Paget Slow Lantern Plate, we give exposures of from 15 seconds to two minutes, according to the density of the negative. When using artificial light for reducing it is necessary to get it properly centred so that there is equal illumination all over the negative, and the order in which our outfit is arranged is as follows :—

We roughly centre our light, but when we look at the focussing screen in the position where our lantern plate will be, it is probably quite unevenly illuminated, and we may be puzzled how to adjust our light and see our focussing screen at the same time. Before bothering about even illumination, place the negative in position and adjust the camera to get the exact amount of reduction required. Perhaps with the negative in focus we may not realize our illumination is defective, but *after* getting the image into approximate focus and size, remove the negative and see if the light on the focussing screen is even. Should it not be so, set a mirror at such a position that the reflected focussing screen may be seen when manipulating the light, which may require to be nearer to, or further from, the condenser ; or raised or lowered. When the light is in correct position replace the negative and make the exposure. The light may be sufficiently cut off while withdrawing the shutter of the slide by interposing a piece of cardboard between the light and the condenser.

MASKING THE SLIDE.

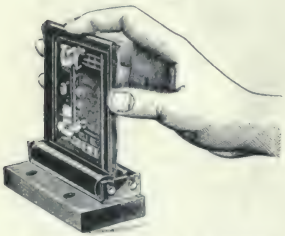
Supposing our slide made and dried, and we find that it answers the requirements laid down for the perfect slide, we proceed to its finishing. Should it not be up to standard, remove the film by placing the plate in a weak solution of hydrofluoric acid, and after rinsing and drying, it will serve as a cover glass. Nothing shows the good taste of the worker more than masking, and the greatest care should be taken to do this properly. Commercial masks are sold in a large variety of shapes, and it is well to obtain a variety of oblong ones with square corners properly cut.

Now and again an oval or round may be necessary, but eschew the rounded or cushion corners, which were no doubt brought out because the makers found a difficulty in cutting good squares. Even when a slide is made by contact it will be frequently improved by using an oblong rectangular mask instead of the full square. Many workers prefer to cut their own masks, and for this purpose boxes of square black paper are supplied with white lines ruled in both directions for accurate cutting. If using these masks they should be placed on a sheet of flat zinc and cut by means of a sharp and pointed knife drawn along a steel straight-edge. Boxes of black gummed strips are also sold of various widths and 3¼ inches long which may be converted into masks by sticking them down parallel to the side of the slides. The slide being masked it may be titled by writing in white ink on the mask—we do not like titles printed on the slide itself—and then two circular white spots should be placed at the top corners either with white ink, or by means of the small gummed spots sold for the purpose. These spots are essential, for every lantern worker then knows how to place the slide in the lantern. Some workers prefer what are known as "duplex" masks, which are white on one side and black on the other. These are placed on the slide with the black side below and the titles are written with black or coloured ink, and the spots at the top of the slide must also be made in the same dark colour.

BINDING THE SLIDE.

This has always been the bugbear of lantern slide making for the amateur, and all sorts of things have been brought out to simplify the process. The slide being masked, it is examined and if there are any little transparent holes they are carefully spotted-out with a sable spotting brush and a little water-colour. All dust is removed and a clean cover glass is placed on it to preserve the film, and the whole is bound together with a paper binding. Some workers prefer to use prepared glass plates with binding strips attached, and these are simple to use, but we should suggest that when they are placed in position, the flaps of paper which fold over on to the slide itself, instead of being moistened only, should be pasted with Johnson's Mountant and then, when they are quite flexible, pressed down into position. Other workers prefer to use an ordinary cover glass and the long strips, and when purchasing strips they should be procured with a special cement surface rather than ordinary gum. Such strips are moistened with hot water, placed at full length on the

table and allowed to remain for a minute until they become limp; the slide and cover glass are then taken between the finger and thumb, placed at one end of the strips so that there is an equal overlap on each side and then wound over from corner to corner, at the same time pressing down the paper on to the slide, but missing the corners. When the last side has received its binding the end is clipped off with a pair of scissors and a cut at each corner will remove a V-shaped piece, thus allowing the paper to fold nicely into position. If the slide is now placed flat on the table and gently pressed, the binders will be likely to nicely adhere, and when it is dry any surplus gum may be cleaned from the two glass surfaces. Perhaps the most useful adjunct for the purpose of binding is the "Specialist Lantern Slide Binder." This consists of two brass rollers covered with rubber; and the slide with cover glass in position, having been placed on a length of moistened binding strip is pressed between the two rollers, as shown in the illustration. It is advisable to keep a moist sponge handy to wipe surplus gum or paste from the rollers from time to time. Although the short length strips may be preferred with this binder, some of our professional friends find no difficulty with the long ones.



THE "SPECIALIST" LANTERN SLIDE BINDER.

TINTED LANTERN SLIDES.

We are frequently asked for particulars of the best methods for colouring lantern sildes, and for those who wish to do this work we shoi ld recommend the Japanese method with soluble aniline colours. The Japanese were, we think, the first to show the possibilities of obtaining artistically coloured slides by this method, and suitable tints are now regularly sold by English firms specially for the work. We may mention the photo tints of Messrs. Johnson, which cost 1/6 per box of 9 colours ready for immediate use; and the books of colours sold by Messrs. Kodak for the same purpose, price 1/-. In preparing a slide for tinting the warm brown tone is not suitable, and we should suggest one of the good brands of plates for black tones, such as the Ilford Special Lantern Plate.

An excellent developer is the following :—

A.	Hydroquinone	160 grains.
	Soda sulphite	2 ounces.
	Citric acid	60 grains.
	Potass bromide	50 grains.
	Water to	20 ounces.
B.	Caustic soda (stick)	160 grains.
	Water to	20 ounces.

For use take 1 oz. A, 1 oz. B, and water 2 ounces.

The plate after development should be fixed as usual, washed and passed through the formalin bath to thoroughly harden the film. The plate is now ready for colouring, which is done by washing on the colours with a soft brush, gradually blending one tint into the other.

ON LANTERN LECTURES.

Slides having been made from the most desirable negatives illustrating the year's work, they may be arranged in the form of a lecture, and any missing slides to give continuity may be purchased. Now, when making up a lecture, it is well to bann the guide book style, and when we say this we do not mean that the lecture should not be informative. But it must be borne in mind that an ounce of personal experience is worth any amount of copy from books. Remembering this we shall not fail to tell our hearers something that will interest them, for the personal note appeals to all. Generally speaking, a lantern lecture should not last much more than an hour, and the matter should be arranged to run consecutively with the slides, so that there are no gaps of silence. For signalling to the lanternist a silent electric signal should be used, for nothing is more distracting to an audience than knocking on the floor with a stick.

NOTICE PLATES FOR LECTURES.

It is often necessary to project title or notices at the beginning or end of lectures, and for this purpose special plates can be purchased with either transparent or black surfaces. The black ones show white lines when scratched with a pin or needle, while those that are transparent may be written on with a pen and Indian ink.

STORING LANTERN SLIDES.

Numerous forms of boxes have been designed for holding lantern slides and those without grooves are preferable, particularly if we wish to economise space. For home use a lantern-slide cabinet is a very desirable acquisition, for the various sets may be kept in labelled drawers and a special box used for taking a set out for showing purposes.

As for the effectual showing of the slides, the best form of lantern illuminant, etc., these will be found in the next chapter.

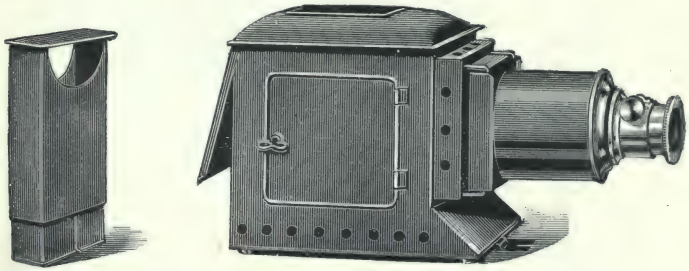
R. Lincoln Cocks.

Reproduction of oil print from negative taken with the Sinclair "Una" Camera.

CHAPTER XXIV.

The Magic Lantern and its Use.

I purposely use the term "magic lantern," although this old title has now fallen into desuetude. Educationalists know the great value of early impressions and I doubt if any entertainment so much impressed me, when a small boy, as a magic lantern show. Even the small oil lantern which we had at home, probably costing not more than 10/6 with slides complete, despite the smoke and smell, was always a source of great delight to the family, and to this day I vividly remember the somewhat fantastic hand-painted slides; but, an event of quite considerable importance was my visit to a really good Christmas exhibition for children, and the moving picture of a man swallowing macaroni had, for me, all the elements of reality, and I would even now be prepared to affirm that I saw a real man swallowing real macaroni, were I not assured that it was only a magic



An inexpensive Lantern with 4-wick Lamp and 4-in. Condenser.

lantern entertainment. Even to-day there is quite an element of "magic" in transporting some scene from France or Italy and seeing it on the screen, even when the work has been entirely my own, and it is on account of these personal early impressions and delights that I would suggest the value of the lantern particularly to those interested in children. The importance of the eye as an educational factor is not sufficiently recognised, and probably the home-made lantern

slide of familiar scenes is a finer stimulus to the imagination than the most perfect of modern moving picture shows.

WHAT DOES IT COST ?

If we consider the subject favourably the first thing affecting most of us is the cost, and in this, as in all other recreations, much depends on the depth of our pockets. It is a great mistake to think that a lantern is necessarily very expensive, for without thinking of the toy sets, which are hardly suitable if we propose to make our own slides, a good lantern, suitable for home use, which takes the regular $3\frac{1}{4} \times 3\frac{1}{4}$ inch lantern slides, may be had for £1 5s. Of course, this is what may be considered as the minimum price, and we will now proceed to describe the construction of the instrument and see in what way the more expensive forms are superior to the quite good and simple one which we have mentioned.

THE CONSTRUCTION OF THE LANTERN.

The general form of the lantern is well known and consists of :—

A body to hold the light.

A condensing lens to collect the rays from the light and transmit them through the slide to the objective.

A carrier to hold the lantern slide in a vertical position near the condenser.

An objective or lens to project the picture in sharp focus on to the screen.

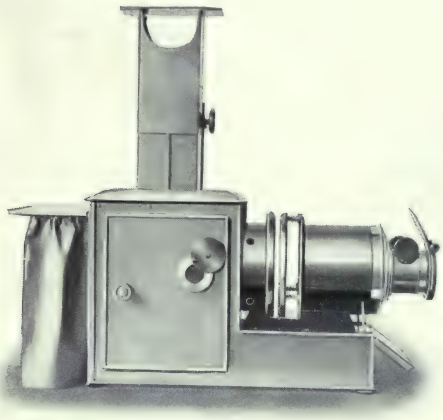
The optical arrangement is shown in the following diagram :—

All of the foregoing parts are necessary, no matter how cheap the lantern may be, and it is only in the perfection of each part and the method of their combination that differences in cost may arise. Let us now discuss the details more fully.

THE LANTERN BODY.

The lantern body in the cheaper lanterns is of japanned tin, but in those of better quality it is made of Russian iron or aluminium, and in the best forms the metal body is covered with an outer case of polished mahogany. With the last mentioned the advantages are those of appearance and coolness. Between the mahogany and the metal

body is a space which carries off all heat to the top of the lantern, and this greatly conduces to the comfort of the operator during a long show. For general use, at a moderate price, there is nothing better than a Russian iron body, and it is desirable that this should be large and well ventilated, with a properly fitting side door to allow of the examination of the light from time to time. The front of the lantern body is usually fitted with a brass stage to support the objective, and this should be very rigid, so that the lens is kept parallel with the surface of the lantern slide.



Best Lantern with Russian Iron Body and Stocks' Lamp.

When it is likely that the lantern will be required in a large room or hall, the front, which holds the objective, must of necessity extend considerably, and where the front is of brass such extension is usually made possible by means of telescopic lengthening tubes. In the more expensive lanterns these tubes are fitted with racks and focussing screws. The reason for this extension will be mentioned later, when we speak of the lens.

THE LIGHT.

The selection of illuminant is the thing that puzzles the prospective lanternist more than anything else, and, undoubtedly, much of his own pleasure depends on its power and efficiency. Still, it must not be imagined that the most powerful light is necessary, particularly when using a lantern at home, providing it is recognised that the size of the picture on the screen should not be greater than can be effectually illuminated.

The illuminants in general use, with their approximate candle powers, are as follows :—

Incandescent Gas	50 to 100
Four-wick Paraffin Oil Lamp	100
Stocks' Paraffin Oil Lamp	130
Three-burner Acetylene Jets	275
Four-burner do.	320-350
Luna Spirit Lamp	300
Kama Electric Lamp, with 3 Nernst filaments,	
100 volt	300
,, ,, ,, 200 volt	600
Blow Through Jets	500
High-Power Ejector Jets	1000
Arc Lamp from usual house supply	400
Arc Lamps with main supply	1000 to 3000

Or more according to current consumed.

These candle powers are only very approximate and are makers' estimates, but serve to give some relation between the powers of the various lights.

GAS BURNERS.

For those who have gas or electricity laid on in their houses, and who want something that will be the least trouble, some light which may be used from the house supply will appeal. For gas users, who are not requiring a very powerful light, an incandescent burner will be favoured. The most powerful form for lantern use is what is known as the "Block Light," but this is only suitable for a lantern with a good-sized body, because of the distance from the bottom of the burner to the centre of the light. Such a light is admirable for a picture not exceeding 3 or 4 feet in diameter.

OIL AND SPIRIT LAMPS.

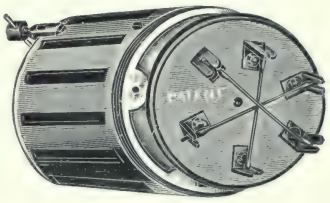
Oil Lamps were formerly the rule in country districts where gas and electricity were unknown, but these have been almost superseded by incandescent spirit lamps. With these lamps, methylated spirit is heated and vaporized, and the vapour mixed with air burns from a bunsen burner and makes a mantle incandescent. The best forms force the mixture

"Luna" Spirit Lamp.

of vapour and air, under pressure, through the burner. This pressure is obtained, in the case of the Regent Lamp, by means of a small pump at the rear of the spirit reservoir, the piston of which is raised and lowered once or twice every few minutes, but in the Luna Lamp it is automatic, due to the vaporization of the spirit by means of heat. The reservoir has a safety valve at the back to relieve the pressure, should it prove greater than the mantle is likely to stand.

ELECTRIC LAMPS.

Electricity is now becoming so general that, for those who have it at command, the Kama Electric Lamp is recommended. This lamp can be attached to any ordinary electric light fitting and gives a very powerful light. Of course, it is not without some drawbacks, the principal being the breakage which occurs with the filaments without apparent cause, and the renewals of the filaments cost 3s. each. Sometimes the filaments last for months and at other times may fail in a few days. Yet the light is so good and the consumption of current so small that its advantages outweigh its disadvantages.



Kama No. 3 Burner.

The Kama Lamp for Lantern use fitted with three filaments in the form of a star costs £2 10s., and the voltage of the house supply must be mentioned when ordering. In my own practice, I frequently use a broken filament for a longer time than when it is whole, by supporting one broken end in contact with the other broken end, and, indeed, such a filament gives more light than one that is whole, because it is reduced in length.

Small Arc Lamps suitable for the supply from the ordinary house fittings are preferred by some workers, although they need greater attention, but have the advantage of giving a sharper picture on the screen, owing to the smaller points of light.

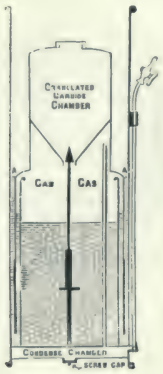
The ordinary carbon or metallic filament lamps used for house lighting are quite unsuitable for lantern use.

ACETYLENE.

Acetylene, if a little more trouble than house gas or electric light, has many points to recommend it, and is very serviceable for those wishing for a cheap light that is sufficiently powerful to be

used in a village school-room. The quality of the light is also of such a character that it may be used with advantage to show colour plates such as autochromes, but of course these, on account of their density must, with such a light, not be enlarged to more than about 18 inches square. The apparatus used for the production of the gas is inexpensive and simple, and is known as an acetylene generator. Apart from the generator, the only requisites are calcium carbide and water. Calcium carbide is obtained by subjecting a mixture of lime and coal to get heat, and has the peculiar property of giving off the acetylene gas when water comes into contact with it.

The generators which permit of this being easily done are of two kinds known as the "carbide to water" and "water to carbide"



Showing interior of Carbide to Water Generator.

The Moss-Abingdon Generator.

varieties, and perhaps a word or two about each may help those who are considering which is better for their particular requirements. For small users in this country, where powdered carbide can always be procured, the carbide to water form is convenient, because immediately the light is turned out gas ceases to be made, and the mixed, dry and powdered carbide can be poured from its container back into its storage tin. One of the best patterns of such a generator is the Moss Acetylite. This is fashioned much as a small gasometer, the top of which contains a receptacle for the powdered carbide which falls through a funnel-shaped opening into the water. When this takes place gas is formed, the gasometer rises, and the valve in the centre of the funnel automatically cuts off the supply of carbide.

These generators are made with both round and square water

reservoirs, and the advantage of the square form is that, holding much more water, a cooler gas is produced and this keeps the burners in better condition. The No. 3 is the best size for use with two or three burners and the No. 5 where four burners are used. Particulars of these are as follows :—

	Charge.	Height.	Diameter.	Will supply
No. 3 ..	1½ lb.	18 in.	6 in.	3 burners 2 hours.
No. 5 ..	2¼ lb.	20 in.	7¼ in.	4 burners 2¼ hours.

The "water to carbide" generators have the advantage that ordinary lump carbide can be purchased almost everywhere, and it is somewhat cheaper than the granulated form. The gas they produce is also cooler and not so likely to clog the burners. The chief disadvantage is that they are not so well suited for photographic-enlarging where the light is constantly being turned "on" and "off" and they are a little more trouble to use than the "carbide to water" variety.

Typical of this form is the Moss-Abingdon generator. From the point of view of the lanternist this has the very great advantage of automatically showing if he has sufficient carbide to suffice for his entertainment with all the burners at work, for the inner gas container does not rise and fall, but steadily sinks as the charge is used.

SIZES.

	Charge.	Height.	Diameter.	Will supply.
No. 31 ..	1½ lb.	19 in.	8 in.	3 burners 2 hours.
No. 32 ..	2¼ lb.	20 in.	9 in.	4 burners 2¼ hours.

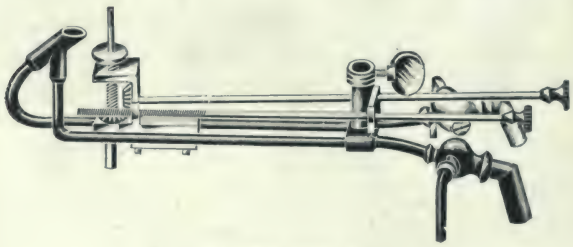
While both larger and smaller generators are made, I have mentioned those that are best for the lanternist. Instructions for the use of the various forms of generators are issued with them, and it is needless for me to mention details in this article. I would only impress upon users of such apparatus that mixtures of acetylene and air are highly explosive and that no naked light should be brought near the apparatus when either charging or cleaning it out, and more importance must be given to this rule than with ordinary coal gas and air, because acetylene and air are about the same weight and, consequently, an explosive mixture might conceivably remain in a vessel for a long time. It is a good thing to blow through all pipes and tubes after use to see if the air passages are quite clear for the next time of use.

O

LIME-LIGHT.

The lime-light is the best of all lights for general use, but to those whose sole knowledge about it is confined to a picture of two formidable looking gas bottles it seems "wropt in mystery." In the old days, the lime-light always meant cumbersome gas-bags, but these have disappeared, with the appearance of compressed oxygen, in all centres of civilization, and even when away from such centres special oxygen-making appliances, combined with ether or petrol saturators, render the gas-bag as extinct as the dodo.

The lime-light is caused through a blowpipe playing on a lime cylinder, and the great heat renders the lime incandescent at the point where the flame impinges. A lime cylinder is the most convenient for the purpose, but is not an absolute necessity. I remember being asked to work a friend's lantern at a country house, and, to my dismay, found that his tin of limes had not been kept properly closed, and they were all slaked and reduced to fragments. Fortunately, he had recently dismantled an old room and its marble mantelpiece was found in an outhouse. Breaking a chip from the mantelpiece,



The Blow-Through Jet.

I fastened it by means of wire to the pin of the jet, and then very gradually heated it, first with the coal-gas flame and then turned on the oxygen, little by little, to obviate its breaking to fragments with the heat. With a little care I was enabled to get a splendid light and all was well, but I should recommend my friends to always see they have good limes, and not rely on finding marble mantlepieces at their disposal.

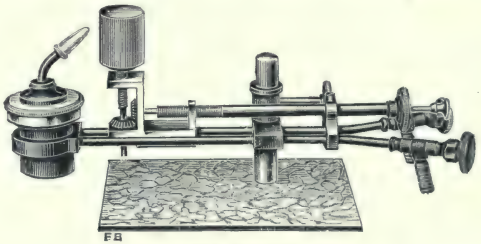
LIME-LIGHT JETS.

The simplest form of jet is that known as the "blow-through." In this case, a pipe carrying the hydrogen or coal-gas terminates in front of a pin holding the lime cylinder, and another pipe carrying the oxygen ends with a small nozzle in the centre and slightly below

the surface of the hydrogen pipe. We use the term hydrogen, but coal-gas, which consists mainly of hydrogen, is used in preference, because it gives some light in itself, and moreover may be obtained through attaching a flexible tube to any ordinary gas supply. A bent union, such as illustrated, is a convenience, because this can be substituted for the gas burner, and the flexible tubing is easily attached.

The coal-gas being lit, the oxygen tap is turned gradually on, and the mixed gases impinging on the lime make it incandescent. It has been found, however, that the heat of the burning gas, and consequently the light given, is enormously increased if the oxygen and hydrogen are perfectly mixed together before they play upon the lime, but, as such a mixture is highly explosive, it is manifestly impossible to mix the gases in any but the smallest quantities, the explosion of which could not do any damage. This is effected by means of various forms of jets, known as the "Mixed Gas Jets" and "Ejector Jets." The gases under pressure are kept in separate cylinders under equal pressures by means of regulators, and are brought to separate tubes on the jets. In the "Mixed Jets" is a small chamber where the gases mix, and the more or less perfect mixing ensures the greater or less light. Consequently, great ingenuity

A bent Union for taking Gas from ordinary bracket.



The Mixed Gas Jet.

has been effected in the formation of these mixing chambers on the best jets, because oxygen is sixteen times heavier than hydrogen, and, therefore, a kind of gas emulsion has to be made, and this emulsion is forced under pressure from the nozzle of the burner. In the case of the "Ejector Jets" the mixture is made by passing the oxygen through a fine orifice into the midst of the hydrogen, which it churns up and forces from the jet on to the lime. With all jets it is preferable to turn on the hydrogen tap first, and after lighting the gas, allow it to play on the lime for two or three minutes to warm it, then turn on the oxygen tap gradually. The light will increase

in intensity up to a certain point and then commence to diminish. When this occurs, turn the hydrogen tap a little further to give more gas, and afterwards again increase the pressure of the oxygen. By adjusting the taps in this way, it is an easy matter to obtain the maximum light that the construction of the jet will allow. The distance of the lime from the jet is also a matter of importance. With "blow-through" jets it is usually found that the lime may be nearly touching the jet. With high-power jets the maximum light may need the lime further away, and as the lime is usually mounted on a rod, which can be adjusted for distance as well as revolved, a trial of various distances will soon enable the operator to see which is best for his purpose. The lime must be revolved from time to time, because it is gradually consumed, and the pit formed by the flame in its surface is apt to deflect the flame outwards and result in a cracked condenser, if this precaution is not taken. When turning off the light it is better to turn off the oxygen first, and sometimes there is a small crack or miniature explosion, due to the firing of the gas in the burner itself, but this is a matter of no consequence and need not cause alarm.

GAS CYLINDERS.

For those using the oxy-hydrogen light there is nothing for convenience equal to cylinders, and these, under the Board of Trade regulations as to testing and filling, may now be regarded as perfectly safe.

For any ordinary lantern entertainment, providing the worker has an efficient jet, a 6-ft. gas bottle, which only measures 14 in. by 4 in. and weighs 10 lbs., will be found sufficient ; but most workers will prefer for home use a bottle holding 12 or 15 ft. of gas, which keeps indefinitely and may be used as required. To deliver the gas from the bottles to the jet, either a fine adjustment valve or a regulator is essential, the latter being the better arrangement. If the regulator is attached to a pressure gauge the exact amount of gas in the cylinder can be noted. Where coal-gas is laid on to the house, only one bottle is required, but, where there is no gas, it is necessary to have a second bottle of hydrogen or coal-gas, or else a "Saturator."

One of the best Saturators is that known as the "Pendant," and this consists of a metallic box filled with absorbent material saturated with methylated ether, through which oxygen is passed, and this enriched oxygen is supplied to the hydrogen side of a mixed gas burner, while the oxygen tap is connected direct to the oxygen

cylinder as usual. The manipulation is then exactly the same as described when using the two gases. It is a little remarkable that Saturators are not used to a greater extent than they are, for instruments of the Pendant type are safe and very easy to manipulate. Moreover, they are much smaller and more convenient in every way than a gas bottle. The No. 1 size measures 13×7×4, weighs about 7 lbs. and is sufficient for jets not consuming more than 3½ feet of oxygen an hour, while the No. 2 of the same size and weighing 8 lbs. is suitable for jets of any power. The only adjunct necessary, apart from a cylinder of oxygen, is some good quality methylated ether ·717 sp. gr., although gasoline of ·650 s.g. may be substituted if the apparatus and oxygen are warmed.

The Pendant Saturator.

Of course, there are some places where cylinders of gas are out of the question, and the modern way to make oxygen for medical or scientific purposes is by means of an "Oxygenerator." This apparatus is constructed to hold a chemical compound known as "Oxylithe," and this gives up oxygen on the application of water, much as does the acetylene generator produce acetylene gas.

The "Oxygenerator."

There is, however no smell and oxygen not being explosive when mixed with air the process is absolutely free from danger. Moreover, the oxygen produced in this way is chemically pure, and such as is not readily obtainable by any other process. The "Oxygenerator" is of strong construction and takes to pieces when not in use. It weighs 25 lbs. and holds 24 cubes of "Oxylithe" (2¼ lbs.), which produce 7 cubic feet of the gas at a pressure of 2 lbs. to the square inch. The "Oxylithe" is sold in hermetically sealed tins and costs 2/6 per lb. The great advantage of such a piece of apparatus for home use is due to the fact that any small quantity of gas can be made at a moment's notice, and gas of such a quality that it may be used for medical purposes should necessity arise.

THE ARC LAMP.

The electric arc lamp for lantern use has undergone many improvements, and excellent automatic arc lamps, which obviate the hand

adjustments of the carbons, are now procurable. Generally speaking, arc lamps are better when used with " direct " or continuous current, because with this current a crater is formed in one of the carbons, giving an intense spot of light. With the alternating current the light is shed in all directions, and the loss that occurs is minimised by setting the carbons at an angle to each other, so that the two terminals are pointing towards the condenser. There is also the drawback of a continuous humming noise when the alternating current is used. Then the voltage or pressure of the current is important. If the voltage is high there is necessarily a great waste of current, which has to be absorbed by a resistance frame, converting the surplus into heat. Most arc lamps require about 60 volts, the resistance which the air separation makes to the passage of the current between the two carbons, but, in practical use, a resistance frame is necessary, because without it when " striking the arc," or in other words, bringing the points of the two carbons in contact to start the current through the apparatus, we remove the air resistance for a moment, and were we not provided with such a resistance frame to convert the excess of supply into heat, we should melt our " fuses," or burn up our apparatus. It is, therefore, preferable to use arc lamps on a " direct " current at a voltage of 100, the extra 40 being absorbed in a resistance frame which acts much as a governor and steadies the light.

THE CONDENSER.

The condenser is the lens which collects the light and passes it through the slide to the objective. Condensers are of various forms and are mostly supplied of 4 inches or 4½ inches diameter. For lanterns with a low-power illuminant the 4-inch condenser is best, for the light is concentrated on a smaller area, and consequently gives a more brilliant picture on the screen. Generally speaking, a 4-inch condenser is ample for all English slides, but 4½-inch is necessary for American and French slides. In the best lanterns with limelight jets or arc lamps it is usual to use a condenser of the " Herschel " form. This consists of a double convex lens and a meniscus lens mounted in a brass cell, the meniscus lens being turned to the light source. The convex lens allows air to get between it and the lantern slide and minimises the annoyance of moisture condensing on the slide during its exhibition. The focus of the lens should be adapted to the focus of the objective that is being used, but, generally speaking, one condenser is sufficient for lenses from 4 to 12 inches

equivalent foci. When longer foci are required a longer focus meniscus lens must be fitted to the condenser, or otherwise the light would have to be brought so close to its surface that, even if the lantern construction rendered it possible, a broken condenser would probably be the result.

THE OBJECTIVE.

The lantern lens or objective is usually of the "Petzval" form, such as the old-fashioned portrait lenses, and it is admirable for the purpose. The larger the diameter of the lens the better so far as the brilliancy of the picture on the screen is concerned. When purchasing a lantern it is well to be prepared for eventualities and to get an instrument which can be added to from time to time. Focussing rackwork barrels for the front of the lantern are recommended, into which lenses of any foci can be slipped as desired. Really first-class lantern objectives of this class are not expensive, as will be seen from the following list :—

Brass Rackwork Focussing Tube to take lenses of various foci and $2\frac{3}{8}$ in. diameter back lens, complete with flasher and slot for tinting colours £1 0 0

Lenses to fit into such tubes of any of the following foci, 7 in., $8\frac{1}{2}$ in., $12\frac{1}{2}$ in., 14 in., 16 in. and 18 in. each 0 16 6

Now the question will naturally be as to what focus lens is required in our lantern, and the following tables will show how to arrive at any information that may be wanted regarding the size of picture, the focus of the lens or the distance from the screen. The usual lens fitted to lanterns is from 7 to 8 inches focus, and the following simple formulæ will answer all our requirements.

LANTERN FORMULÆ.

To find at what distance from the screen the lantern must be placed to get a picture of desired size. Multiply the diameter of picture required by the focus of the lens and divide by the diameter of the slide.

Example. Size of picture desired 8 feet, focus of lens 7 inches, diameter of slide 3 inches.

$$\text{Then } \frac{8 \times 7}{3} = \frac{56}{3} = 18\tfrac{2}{3} \text{ feet.}$$

To find what lens focus must be used when distance from the screen is known and also the size of the picture.

Multiply the distance from the lantern to the screen by the size of opening in the slide and divide by the diameter of the disc.

Example. Length of room 50 ft., diameter of slide 3 inches, size of picture 12 ft.

Then $\frac{50 \times 3}{12} = \frac{150}{12} = 12\frac{1}{2}$ in. focus lens.

To find what size picture will be produced at a given distance between the lantern and screen, the focus of the lens being known.

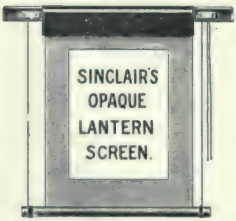
Multiply the distance from the lantern to the screen by the size of opening in the slide and divide by the focus of the lens.

Example. Distance between lantern and screen being 40 ft., opening in slide 3 in. and focus of lens 10 in.

Then $\frac{40 \times 3}{10} = \frac{120}{10} = 12$ feet diameter of picture.

THE LANTERN SCREEN.

A distempered white wall is the best screen that can be used, but failing this an almost equally efficient substitute is a Sinclair Opaque Screen. This consists of canvas covered with white distemper, mounted on roller with pulley cords, so that it can be rolled up when not in use. Sizes up to 15 feet square can be supplied, but naturally such large sizes are not very portable, and for travelling purposes ash poles of various lengths are joined together with brass collars. Particulars of such portable stands, on which calico and linen screens can be stretched, will be found in any catalogue.



TO GET AN EVEN AND PERFECT LIGHT ON THE SCREEN.

The adjustment of the light is always a matter of some little difficulty to the beginner, and by following our instructions the best illumination may be obtained with the minimum of trouble. We set up the lantern in the place it has to occupy and, from the tables we have given, the size of the picture may be known in advance, or the position of the lantern determined. We see that our light is burning properly and slide the

illuminant into the lantern body, not paying much attention to perfection, providing we see some light on the screen. We next insert a lantern slide with fine detail, such as a map, in the carrier upside down and with the front of the slide facing the condenser, and draw or rack out the objective till the image is approximately sharp on the screen. Now remove the lantern slide from the carrier and proceed to adjust the light so that the rectangular opening of the lantern slide carrier is evenly illuminated on the screen. We shall probably find that this is a matter requiring adjustment, and one side or the other, or top, or bottom is not properly lit. This will show that the light is out of proper centre. If the shadow is at the top, the light is too high; and if the shadow is at the bottom, the light is too low; in fact, just the contrary to what we should expect, unless we remember that the lens transposes the image. After adjusting the position to get the margins correct, we may possibly find we have a shadow in the centre, and then the light must be drawn slightly away from the condenser. Should, on the other hand, there be a marginal fringe of colour we must push the light nearer to the condenser. After obtaining the most even illumination possible, all is ready for work.

A NATIVE OF DORT.

Taken with N.S. Patent Reflex and long-focus Tele Lens.

Law for Photographers.

By E. B. V. CHRISTIAN, LL.B.

It is chiefly in matters of copyright that the photographer meets Old Father Antic the Law. In the lesser transactions of life, buying, selling and getting gain, marrying, company promoting and the like, the photographer is but as an ordinary man. Until 1862 he had no statutory protection in his vocation, or avocation ; but in that year the 25 and 26 Vict., c. 68, since re-christened "The Fine Arts Copyright Act 1862," included photography in the protection given to paintings and drawings, as if—to quote the language of Lord Bowen—"as if it were an art." That act has now been repealed, after a duration of half a century ; but as questions may, for some years to come, arise concerning photographs which acquired copyright before 1st July, 1912, it will still be convenient, for the sake of law as well as of history, to have the words of the old statute accessible.

Section 1 of the act of 1862 was as follows :—

> "The author, being a British subject or resident within the Dominions of the Crown, of every original painting, drawing, and photograph which shall be or shall have been made either in the British Dominions or elsewhere, and which shall not have been sold or disposed of before the commencement of this Act, and his assigns, shall have the sole and exclusive right of copying, engraving, reproducing, and multiplying such painting or drawing, and the design thereof, or such photograph, and the negative thereof, by any means and of any size, for the term of the natural life of such author, and seven years after his death ; provided that when any painting or drawing, or the negative of any photograph, shall for the first time after the passing of this Act be sold or disposed of, or shall be made or executed for or on behalf of any other person for a good or a valuable consideration, the person so selling or disposing of, or making or executing the same shall not retain the copyright thereof, unless it be expressly reserved to him by agreement in writing, signed at or before the time of such sale or disposition by the vendee or assignee of such painting or drawing, or of such negative of a photograph, or by the person for or on whose behalf the same shall

be so made or executed, but the copyright shall belong to the vendee or assignee of such painting or drawing, or of such negative of a photograph, or to the person for or on whose behalf the same shall have been made or executed ; nor shall the vendee or assignee thereof be entitled to any such copyright unless, at or before the time of such sale or disposition, an agreement in writing signed by the person so selling or disposing of the same, or by his agent duly authorised, shall have been made to that effect."

The modern parliamentary draftsman does not proceed in this straightforward, breathless way. He is fond of sections, sub-sections, definition clauses, notes and schedules. The Copyright Act, 1911 —" an act to amend and consolidate the law relating to " all classes of " copyright," which came into force on 1st July, 1912, has a delusive appearance of being easy reading. It will doubtless be found some day to have provided a fair share of riddles for judicial solution.

Copyright means " the sole right to produce or reproduce the work or any substantial part thereof in any material form whatsoever." The " work " is any " original . . . artistic work "; so far have we moved from the days of Lord Bowen's jeer, that every original photograph is now by statute not merely a work of art, but (at least for copyright purposes) artistic work. The right is not only to prevent reproduction of a published photograph, but also to prevent publication of an unpublished one. And " photograph " includes photo-lithograph, and any work produced by any process analogous to photography.

The conditions which must be fulfilled to acquire copyright are (for a published work) first publication—which means the issue of copies to the public, or exhibition in public—in the parts of His Majesty's dominions to which the act applies ; and (for an unpublished work) the author's being a British subject or a resident within those parts when the photograph is taken. Moreover, the photograph must be " original."

What is an Original Photograph ?

" We can understand," said Mr. Justice Blackburn, " the difference between an original painting or design and a copy of it ; but it is hard to say what an original photograph is. All photographs are copies of some object—such as a painting or statue, and it seems

to me that a photograph taken from a picture is an 'original photograph,' so far that to copy it is an infringement of this statute." Every photograph is original if taken by independent effort; but there is no copyright in a subject, and a copyright photograph does not prevent another being taken by independent effort from the same subject.

In the U.S.A., it has been held that there must be some evidence that the photographer has exercised an intellectual choice of subject-matter, expression, arrangement, light, or other circumstances or conditions which go to the production of an artistic photograph.

Subject to the exceptions mentioned in the act the author of the photograph is to be the owner of the copyright. The judges in applying the old law found some difficulty in defining "author" as applied to photography. "The nearest I can come to it," said Lord Esher, "is that it is the person who effectually is, as near as he can be, the cause of the picture which is produced—that is, who has actually formed the picture by putting the people into position." Lord Bowen thought him the man who "really represents, or creates, or gives to the ideas, or fancy, the local habitation"—who superintends the arrangement, the pose or grouping. So, under the old law, registration of a firm as authors of a photograph taken by one of their employés, at the instance of their manager, was held to be bad; the employé, not the firm, was the author. But the principal person, under whose immediate direction a photograph was taken, was its author, notwithstanding that another person acting under his direction posed the subject and performed other manual operations. As the duration of the copyright under the Act of 1862 depended on the life of the author—it expired seven years after his death—photographers employing assistants (and taking assignments of copyright from them) had, as Lord Esher said, to consider their state of health, as well as their skill. But the new act places the law on a more rational basis. The person who was the owner of the negative at the time when it was made, is to be deemed the author of the work. A photograph taken by an assistant or apprentice on behalf of his employer is now the copyright of the employer—except in the case next mentioned.

The Photographer and the Sitter.

Both under the old and the new law the photographer is not the owner of the copyright, when the photograph is ordered by the

sitter or some other person and is to be paid for. The Act of 1862 used the words "for a good or valuable consideration." The question arose, what is a good consideration? Money, of course, is a "good consideration"; and it is still good when the photographer accepts a smaller rate of payment than usual. The copyright in that event is still the sitter's, unless the photographer obtains it by express agreement. Nor is actual payment necessary to give the sitter the copyright; it is sufficient that he agreed and is liable to pay. Difficulty arose when no payment was intended. A photographer who without charge photographed an actress, giving her some complimentary copies, and selling others, was held to be entitled to the copyright, the actress's permission to take the portrait not being a "good or valuable consideration;" and a person to whom the actress gave a print was held to be committing a breach of copyright by reproducing it in a magazine. On the other hand, where a photographer took photographs of a school at his own expense, the proprietor being at liberty to purchase copies or not, he pointing out what rooms should be photographed, posing the cricket eleven, etc., it was held that there was "good consideration" and the photographer was not the owner of the copyright.

The words of the new act are slightly different. "Where in the case of an engraving, photograph or portrait, the plate [which includes negative] is ordered by some other person and is made for valuable consideration in pursuance of that order, then, in the absence of any agreement to the contrary, the person by whom such plate or other original was ordered, shall be the first owner of the copyright." It will be seen that the sitter, or other person who orders the photograph, is the first owner, but not (unless the negative is to become his property) the author. Hence, to maintain copyright in an unpublished portrait it may be necessary to show that the photographer was a British subject or resident in the dominions to which the act applies.

The language of the new act is a little unusual—"the plate was ordered." The sitter does not usually order a negative; he orders "photographs" or prints from a negative which remains the property of the photographer. But the courts will probably hold that you "order" a negative, when you order photographs for which the negative is made, and that you so become the owner of the copyright although the negative is not yours.

Although the photographer employed to take a portrait remains the owner of the negative, he is not entitled without the customer's authority to sell, dispose of, or publicly exhibit copies of the photograph, and an injunction may be granted restraining him from doing so. The sitter cannot claim the negative ; the photographer cannot use it without permission. He must not sell it, or by way of trade expose or offer it or prints from it for sale or, again by way of trade, exhibit in public ; and exhibition in his window or probably in his studio is " public." The rights are the same as to surplus negatives, or negatives not approved, where, as generally happens, several negatives are taken at a sitting from which the sitter is to make a selection, *e.g.*, in commercial photography, for catalogues, the price is sometimes quoted as so much for the negative and so much for each print. In such a case the negative may become the property of the customer.

The amateur who takes a portrait of a friend, is, of course, the owner of the copyright ; he may restrain any one making copies, he may even sell the copyright and there is nothing (except the law of libel and the loss of friendship) to prevent his exhibiting his work. One odd result seems to follow from the law in the case of groups, which, as every one knows, are apt to contain good portraits.

> Finally, my Hiawatha
> Tumbled all the tribe together,
> (Grouped is not the right expression),
> And, as happy chance would have it,
> Did at last obtain a picture
> Where the faces all succeeded ;
> Each came out a perfect likeness.

So runs a passage which is doubtless a classic in the literature of photography. Assuming Mr. Hiawatha to have been paid for his work, the customer became the owner of the copyright of the portrait of every person photographed. The man who orders and pays for the picture may if he chooses prevent a member of the group obtaining copies of the photograph, however well he or she " comes out " in it ; or, worse, he may copy, exhibit, even publish, the portrait of any one there, though the subject himself calls it a caricature and faintly hopes he " does not really look like that."

It is a breach of copyright not only to reproduce the whole photograph, but even " any substantial part thereof." The courts will probably hold that every portrait is a " substantial part " of a group ; which of us so photographed would think otherwise ?

Length of Copyright.

Under the old law the term was the life of the author and seven years after. The new law (less favourable to photographers than to other artists and authors) gives fifty years from the making of the original negative. Several steps go to the making of a negative, and the first step, the exposure of the plate, may be substantially earlier than its completion, ready for printing. The statute does not distinguish, and the photographer on his way to the law courts to protect his right should probably assume that his copyright will have expired fifty years after the moment when the plate was exposed. The new act affects old copyrights. It extends the term of a photograph's copyright, provided that copyright still existed on 1st July, 1912. If the photographer died on or before 30th June, 1905, his copyright had gone before the new act came into force, but, if he died after 30th June, 1905, the copyright was subsisting. In that event the copyright is extended, as though the new act had been in force when the photograph was taken, and lasts for fifty years from the making of the negative.

As to unpublished photographs there is no limit to the term of protection. The old common law right, abolished by a section, but restored by a footnote to a schedule of the act, enables the owner to prevent publication by any one, so long as the author does not "publish" the photograph himself.

Registration and Assignment.

The Act of 1862 required registration at Stationers' Hall as a condition of protection. Only those piracies which occurred after registration involved liability to penalties, and the failure to comply with the strict terms of the law defeated some "meritorious" actions. But the subject is now unimportant, for all registration is abolished by the new law. No registration is necessary to establish the photographer's right to sue; and, indeed, he is to be presumed to be the author of the copyright, so that he need not furnish evidence on that point, unless the defendant challenges his title.

All assignments of copyright must be in writing, signed by the assignor; so must be licences to reproduce copyright work. Although the copyright lasts for fifty years the author cannot dispose of it for a term of more than twenty-five years after his death. After that time, in spite of any such assignments, it reverts to his executors or administrators. Thus does the legislature preserve the rights of our

descendants in spite of our recklessness and heedlessness and save for them the financial benefits of the works by which we immortalize ourselves. But the author may *by will* dispose of these profits and cut off wife and children without a copyright to bless themselves with.

What is an Infringement?

It is an infringement to do anything which the author has, under the act, the sole right to do—to produce or reproduce the work, or any substantial part of it; or to sell or let for hire, or exhibit in public, or offer for sale, or to distribute anything which infringes copyright. It is forbidden to import into the United Kingdom copies made abroad of a copyright photograph, and the owner of the copyright on giving notice to the Commissioners of Customs or Excise secures their aid in preventing importation.

It is not an infringement (there the photographer looks at the question from the other side, not as victim, but as possible infringer) to make or publish a photograph of a work of sculpture or artistic craftsmanship, if permanently situate in a public place or building.

A drawing made on a larger scale from a photograph is an infringement. A photograph made from an engraving of a picture infringes the copyright in the original picture. A crayon drawing of the head was made from a photograph of Queen Alexandra; this was put on another body and re-photographed; the proprietors of the copyright of the original photograph were held entitled to an injunction restraining the infringement. Photographs of non-copyright pictures are copyright, but the photographer cannot, of course, prevent another person making an exactly similar photograph from the same original. This remark, indeed, applies to all photographs. The photograph must not be copied; but the photographer has no exclusive right in the subject and any other photographer may, although it is a shabby thing to do, essay to obtain the same picture for himself.

Remedies.

The owner of the copyright in a photograph may obtain an injunction restraining the infringement, may recover damages, an account (and payment) of profits made by the infringer, and the delivery to him of all "plates," *i.e.*, negatives, and copies infringing his copyright. But if the defendant satisfies the court that he was ignorant of the existence of copyright and had no reasonable ground

to suspect it, he is exempt from anything but an injunction. Unless the courts are indulgent it is difficult to see how this new provision will avail a defendant. Photographs do not come into existence fortuitously; the existence of a photographer who is the owner of the copyright ought, one would think, to be presumed. It is doubtless with the view of preventing harsh or oppressive actions on account of small injuries that the act gives to the Court an absolute discretion as to costs. A plaintiff, therefore, who, having sustained only trifling damage, refuses reasonable offers of compensation and insists on his legal rights, may not be allowed his costs and—possibly—may even be ordered to bear the defendant's.

An action in respect of infringement of copyright must be brought within three years of the infringement.

In addition to his remedies in the Civil Courts, an aggrieved author may, in some cases, appeal to the criminal law. It is an offence punishable on summary conviction knowingly to make for sale or hire any infringing copy of a copyright work, or to sell or let for hire, or expose or offer for sale or hire, or to distribute, infringing copies, or by way of trade to exhibit them in public, or to import such copies into the United Kingdom. The penalty is a fine of 40s. for every copy, not exceeding £50 in respect of the same transaction, and on a second offence imprisonment for not more than two months. The offence must be "knowingly" committed; and the burden of showing guilty knowledge is on the prosecutor.

Other Things Forbidden.

Some sections of the Fine Arts Protection Act 1862 remain unrepealed. Under these it is an offence fraudulently to

(1) Sign or affix, or cause to be signed or affixed, to any photograph, or the negative thereof, any name, initials or monogram.

(2) To sell, publish, exhibit or offer for sale, publication, or exhibition, any photograph or negative, bearing the name, initials or monogram of any person who did not make it.

(3) To utter, dispose or put off any copy or colourable imitation of a photograph, as having been made by the author of the work from which it was copied or imitated.

(4) During the life of any author of a photograph who has sold or parted with the possession of it, to sell or publish such photograph altered, by addition or otherwise, as the unaltered work of the author.

The penalties on conviction are the forfeit to the person aggrieved of a sum not exceeding £10 or double value, to be recovered on summary proceedings before magistrates. It will be seen that fraudulent intent is the essence of the offence. But even without such intent, the production of an altered photograph attributed to the author of the unaltered work may be restrained in the civil courts by injunction. In that case it must be shown that the alteration is such as to prejudice the plaintiff's reputation.

The Photographer at Large.

Although a new copyright in architectural works is created by the act, the privileges of the photographer have been preserved. The legislature (borrowing an idea, as Mr. S. P. Kerr has pointed out in his edition of The Copyright Act, from the laws of Denmark and Belgium) has given protection to the architect of a building of artistic character or design. But the publication of photographs of any architectural work of art is not a breach of this new right, unless the photographs are (and it is difficult to see how they can be) "in the nature of architectural drawings or plans."

Indeed the laws of England recognise no right to privacy. The photographer may not commit trespass in search of his quarry. But having got his victim in the open he may photograph him. A man has no copyright in his face. The snap-shotter may publish his work unreproved, except on the score of want of taste. If Mr. Alderman Jones tumbles on a slide, or falls asleep, an ungraceful lump in a hammock, he can no more prevent the local paper publishing photographs of him in those undignified positions than Mr. Pickwick could prevent the artist from depicting him in the pound. Judges by virtue of their inherent right to control proceedings in their courts do forbid the taking of photographs of witnesses and others, and disobedience to such an order is doubtless contempt of court. But less august persons have no such convenient power.

The only remedy for the aggrieved is the law of libel. The photographer may be reminded that it is libellous by picture, as well as by writing, to hold a fellow-creature up to ridicule, hatred or contempt. There have been pictures in the illustrated papers which excited all these emotions. No action for libel by photo graph appears to be yet recorded in the recognised reports ; time will doubtless supply that omission. That such an action has been so long delayed shows that even our vanity may be restrained by the fear of ridicule.

A DUTCH CANAL.
Taken with the N.S. Reflex.

A WORCESTERSHIRE HIGHWAY.
Taken with the N.S. Reflex.

Appendix.

Weights and Measures.

APOTHECARIES' WEIGHTS.

20 grains = 1 scruple.
3 scruples = 1 dram.
8 drams = 1 ounce.
12 ounces = 1 pound.

This gives 480 grains to the ounce and 5760 grains to the pound. When you buy 1 ounce of a chemical from your dealer you will only get 437½ grains, because he sells by avoirdupois weight, yet if you obtain one pound, you will get 7000 grains, because there are 16 avoirdupois ounces to the pound.

AVOIRDUPOIS WEIGHT.

437½ Grains = 1 Ounce.
16 Ounces = 1 Pound = 7000 Grains.

¼ ounce = 109 grains ; ½ ounce = 219 grains ; ¾ ounce = 328 grains.

COINS AS WEIGHTS.

Silver coinage is minted by weight in proportion to its value, *viz.*, 436$\frac{4}{17}$ grains for every 5s. The threepenny bit is 21·8 grs. ; a sixpence, 43·6 ; shilling, 87·2 ; florin, 517·4 ; half-crown, 218 grs. One sovereign weighs 123·27 grs. ; the half-sovereign, 61·63 grs.

¼ oz. (avoir.) = one half-penny and one threepenny piece.
½ ,, ,, = two half-pennies and a farthing.
1 ,, ,, = three pennies (or five half-pennies).
2 ,, ,, = six pennies (or ten half-pennies).
4 ,, ,, = twelve pennies or twenty half-pennies.

FLUID MEASURE.

60 Minims = 1 Drachm.
8 Drachms = 1 Ounce = 480 Minims.
20 Ounces = 1 Pint = 160 Drachms = 9600 Minims.
2 Pints = 1 Quart = 40 Ounces = 320 Drachms.
4 Quarts = 1 Gallon = 160 Ounces = 1280 Drachms.

1 fluid ounce of water weighs 437½ grains, therefore every minim weighs 0·91 grains.

FRENCH COINS AS METRIC WEIGHTS.

(Lord Crawford's Table.)

With the bronze coins each centime weighs 1 gramme. Thus 5 centimes equal 5 grammes ; 10 centimes equal 10 grammes, and so on.

The weights of the silver coins are as follows :—50 centimes = 2½ gms., 1 franc = 5 gms., 2 francs = 10 gms., 5 francs = 25 gms.

The unit of weight in the metric system is the gramme, written "gm.," and this is about 15 grains, 1 avoirdupois ounce = about 30 gms.

The abbreviation "kilo" is usually employed for kilogramme = 1000 grammes = 35·274 ozs. avoirdupois. The unit of liquid measure is the cubic centimeter (c.c.). 1 c.c. = about 17 minims, 1 fl. oz. = about 30 c.c.

A litre is 1000 c.c.

Pinhole Photography.

WATKINS' TABLE OF PINHOLE DISTANCES.

Watkins' Power Number.	Inch.	Nearest Needle Number.	Most suitable distance.
3	·053	No. 1	40 inches.
4	·040	4	20 ,,
5	·032	5	15 ,,
6	·027	7	10 ,,
7	·023	8	8 ,,
8	·020	10	5 ,,
10	·016	12	3½ ,,
12	·013	13	2½ ,,

TO CALCULATE EXPOSURE.

Multiply the W.P. No. by the distance from pinhole to plate (focus), and use the result as an *f* value to calculate the exposure in the usual way. Then, whatever the exposure indicated in seconds (or fraction of a second) give the same number (or fraction) of minutes. Thus, W.P. 6 pinhole at 5 inches would be *f*/30 and if used at 10 inches would be *f*/60. A distance less than the length of the plate will give a wide-angle picture, a distance twice the length of plate or more, a narrow-angle picture. —*The Watkins' Manual.*

Lens Facts.

Table showing distance of object upon which to focus with any stop in order to secure the greatest depth (hyper focal distances).

To Find the Hyper Focal Distance the formula is :—

Focal length squared, ÷ ratio of stop × circle of confusion.

Now when making these tables it is generally assumed that a point represented as a circle of confusion not exceeding $\frac{1}{100}$th inch in diameter will be considered satisfactory as regards definition in the negative. Then by the above formula suppose we have a lens of 5-inch focus with stop *f*/8 the hyper focal distance will be

$$\frac{5 \times 5}{8 \times \frac{1}{100}} = \frac{25}{\frac{8}{100}} = \frac{25}{1} \times \frac{100}{8} = \frac{2500}{8} = 312\tfrac{1}{2} \text{ inches.}$$

or 26 feet $0\frac{1}{2}$ inch.

If we, therefore, with such a lens and stop focus on 26 feet we shall have objects from half that distance (13 feet) to Infinity in good focus.

Mr. Welborne Piper, in his useful book on "The Lens," has pointed out the interesting fact that if we divide the hyper focal distance by 1, 2, 3, 4, 5, etc., we shall get a set of distances such that, if we focus on any one of them, the next two distances on the scale are the distances of the furthest and nearest objects in focus. Say the hyper focal distance is 30 feet, then 30/1, 30/2, 30/3, 30/4, etc., will represent 30, 15, 10 and $7\frac{1}{2}$ feet, and if we focus, say, on 10 feet then the 15 and $7\frac{1}{2}$ ft. will be the near and far depths, or on 30 ft. then on Infinity and 15 ft.

To Calculate Near Depth when Focussing on near objects.

$$\text{Formula.} — \frac{\text{Distance of object in focus} \times \text{Hyper focal distance.}}{\text{Distance of object in focus} + \text{Hyper focal distance.}}$$

Example. Hyper focal distance 26 feet object at 8 feet,

$$\text{then the near depth} = \frac{26 \times 8}{26 + 8} = \frac{208}{34} = 6 \text{ ft. } 1\tfrac{1}{2} \text{ in. approx.}$$

For far depth the formula is

$$\frac{\text{Distance of object in focus} \times \text{hyper focal distance.}}{\text{Distance of object in focus} — \text{hyper focal distance.}}$$

If the sharp focus is secured at Infinity, then, with the stop indicated, all objects are in focus from the above distances up to Infinity. If, however, the pointer is set to the above distances then, with the stop indicated, all objects are in focus from half the distance focussed up to Infinity. These figures are based on a circle of confusion of $\frac{1}{100}$th of an inch, and the distances must be reduced if greater sharpness is desired.

Focal length of Lens in inches.	Apertures marked on Stops.													
	f/4	*f*/5·6	*f*/6	*f*/7	*f*/8	*f*/10	*f*/11	*f*/15	*f*/16	*f*/20	*f*/22	*f*/32	*f*/44	*f*/64
	BEST POINT ON WHICH TO FOCUS IN FEET.													
4	33	24	22	19	17	13	12	9	8	7	6	4	3	2
4¼	38	27	25	21	19	15	14	10	10	7	7	5	3½	2½
4½	42	30	28	24	21	17	15	11	11	8½	7½	5½	4	3
4¾	47	34	31	27	24	19	17	12	12	9½	8½	6	5	3
5	52	36	35	30	26	21	19	14	13	10½	9½	6½	5½	3½
5¼	57	40	38	33	28	23	21	15	14	11½	10½	7	5½	3½
5½	63	45	43	36	31	25	23	17	15	12½	11½	7½	6	4
5¾	68	50	46	38	34	27	25	18	17	13½	13	8½	6½	4
6	75	54	50	42	38	30	28	20	19	15	14	9	7	4½
6¼	81	58	54	46	40	32	29	22	20	16	15	10	7½	5
6½	87	62	58	50	44	35	32	23	22	17½	16	11	8	5½
6¾	94	67	63	54	47	38	34	25	24	19	17	12	8½	6
7	101	72	68	58	51	40	37	27	25	20	18	12½	9	6
7¼	109	78	73	62	54	44	39	29	27	22	20	13½	10	6½
7½	117	83	78	64	58	47	42	31	29	24	21	14½	10½	7
7¾	124	90	83	71	62	50	45	33	31	25	22	15½	11	7½
8	132	96	88	76	68	52	48	36	32	28	24	16	12	8
8¼	141	102	94	80	71	56	51	37	35	29	25	17½	12½	8½
8½	151	107	100	84	76	60	54	40	38	30	27	19	13½	9
8¾	156	114	104	89	78	63	57	42	39	32	29	20	14	10
9	168	120	112	96	84	67	61	45	42	34	31	21	15	10½
9¼	180	127	116	101	90	71	65	47	45	35	32	22	16	11
9½	190	133	125	107	95	75	68	50	47	37	34	24	17	12
9¾	197	141	131	113	99	79	72	52	50	39	36	25	18	12½
10	208	148	140	120	104	83	75	55	52	42	38	26	19	13

THE EFFECTIVE APERTURE OF A STOP. "When a stop is placed between the combinations of a double lens, the effective aperture is not given by measuring its diameter. Rays of light, directly they pass through the outside lens, converge, and evidently more light will pass through the stop than it would do were it in front of the lens, as it is in a single lens. The proper way to ascertain the effec-

tive aperture of a stop in this instance is to focus some distant object, and to place in the position of the ground glass a piece of card with a small hole pierced in the centre. If a candle be brought near the hole, a circle of light will illuminate the front lens. The diameter of this circle of light which illuminates the lens will be a measure from which the effective aperture can be calculated. Every stop should be placed in position, and the diameter of the illuminated circles measured and noted."—Sir W. Abney. "Instructions in Photography."

The diameters of the illuminated circles of light divided into the distance between the stop and the focussing screen, will give the focal values or *f* numbers.

APPROXIMATE INFINITY FOR LENSES OF VARIOUS FOCAL LENGTHS.

By C. Welborne Piper, from "The First Book of the Lens."

Focal Length. Inches.	Distance of Focussing Screen behind Principal Focus.			
	$\frac{1}{100}$ in.	$\frac{1}{200}$ in.	$\frac{1}{500}$ in.	$\frac{1}{1000}$ in.
1	3 yds.	7½ yds.	15 yds.	30 yds.
2	11 ,,	28 ,,	55 ,,	110 ,,
3	25 ,,	63 ,,	125 ,,	250 ,,
4	45 ,,	113 ,,	225 ,,	450 ,,
5	70 ,,	175 ,,	350 ,,	700 ,,
6	100 ,,	250 ,,	500 ,,	1000 ,,
7	136 ,,	340 ,,	680 ,,	1360 ,,
8	178 ,,	¼ mile	½ mile	1 mile
9¾	264 ,,	660 yds.	¾ ,,	1½ miles
11¼	351 ,,	½ mile	1 ,,	2 ,,
12¾	434 ,,	1085 yds.	1¼ miles	2½ ,,
13¾	525 ,,	¾ mile	1½ ,,	3 ,,
16	700 ,,	1 ,,	2 ,,	4 ,,
17¾	875 ,,	1¼ miles	2½ ,,	5 ,,
19½	1056 ,,	1½ ,,	3 ,,	6 ,,
21	1225 ,,	1¾ ,,	3½ ,,	7 ,,
22½	1406 ,,	2 ,,	4 ,,	8 ,,
24	1600 ,,	2½ ,,	4½ ,,	9 ,,
25	1 mile	2½ ,,	5 ,,	10 ,,
28	1¼ miles	3¼ ,,	6½ ,,	13 ,,
30	1½ ,,	3¾ ,,	7½ ,,	15 ,,
33	1¾ ,,	4½ ,,	9 ,,	18 ,,
35	2 ,,	5 ,,	10 ,,	20 ,,

By focussing accurately on distances not less than those given, we ensure that the focussing screen is within 1/100, 1/250, 1/500, or 1/1000 in. from the true principal focus.

TELE-PHOTO CALCULATIONS.

To find the Camera Extension necessary for a given magnification.

Multiply the focal length of negative lens by magnification less 1.

Example. Magnification 5 and negative lens 3 inches, then $3\times(5-1)=3\times4=12$. Therefore, 12 inches would be the camera extension.

It will be apparent that a shorter focus negative lens would need less camera extension for the same number of magnifications, but, although this is the case, the shorter negative lens means smaller covering power, and the plate might not be covered to the margins with a low magnifying power.

To find the magnification possible with a given camera extension.

Divide the camera extension by the focal length of negative lens and add 1.

Example. With a camera extension of 10 inches and a negative lens of $1\frac{1}{4}$ inches, what magnification can we obtain ?

Then $\frac{10}{1\frac{1}{4}}+1=8+1=9$ magnifications.

To find the focal length of the complete lens.

Multiply the focal length of the positive lens by the number of magnifications.

U.S. NUMBERS ON LENSES.

Some people imagine that U.S. refers to the "United States," because Kodaks are usually so marked. The letters, however, mean Uniform Standard, and were formerly adopted by the Royal Photographic Society to represent the relative values of the lens apertures. The Society, however, now uses for its standard, numbers indicating the proportion between the stop and the focus of the lens, and this method is now almost universal.

U.S. Nos.	1	2	4	8	16	32	64	128	256
equal	*f*/4	*f*/5·6	*f*/8	*f*/11·3	*f*/16	*f*/22·6	*f*/32	*f*/45·2	*f*/64

USEFUL TABLES FOR ENLARGING, REDUCING OR COPYING.

When Enlarging, Reducing, or Copying we frequently want to know the positions for lens, negative and enlarging board. The formula is a simple one.

Multiply the focus of the lens by the times of enlargement or reduction plus one. For instance, if we wanted to enlarge a ¼-plate to 8½×6½, this would be twice and not four times, as many people imagine. The 8½×6½ is double the length of the 4¼×3¼, and it is this that decides the degree of enlargement and not the difference in area. Supposing our lens was 7 inches in focus, then in this case 7 in. × (2+1) = 21 inches, the distance from the lens to the enlarging easel. To find the distance from the lens to the small plate we divide the distance from the screen by the times of enlargement. In the case named it would be 21 ÷ 2 = 10½ inches. If we were working reductions in a camera the method would be exactly the same but in this case the 21 inches would be the distance from one copy to the lens and the 10½ inches the necessary camera extension from the lens to the plate.

The following table will save calculation.

Reproduced to :—	Same size.		Double.		3 times.		4 times.		5 times	
Distance from lens to :—	Copy.	Enlar.	Copy.	Enlar.	Copy.	Enlar.	Copy.	Enlar.	Copy.	Enlar.
With lens of	ins.	ins	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.
4 in. focus	8	8	6	12	5⅜	16	5	20	4⅞	24
5 ,,	10	10	7½	15	6⅜	20	6¼	25	6	30
6 ,,	12	12	9	18	8	24	7½	30	7¼	36
7 ,,	14	14	10½	21	9⅜	28	8¾	35	8⅜	42
8 ,,	16	16	12	24	10¼	32	10	40	9¾	48
9 ,,	18	18	13½	27	12	36	11¼	45	10¾	54
10 ,,	20	20	15	30	13¼	40	12½	50	12	60

Reproduced to :—	6 times.		7 times.		8 times.		9 times.		10 times.	
Distance from lens to :—	Copy.	Enlar.	Copy.	Enlar.	Copy.	Enlar.	Copy.	Enlar.	Copy.	Enlar.
With lens of	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.
4 in. focus	4⅝	28	4⅝	32	4½	36	4½	40	4⅜	44
5 ,,	5⅞	35	5¾	40	5⅝	45	5⅝	50	5½	55
6 ,,	7	42	6⅞	48	6¾	54	6⅝	60	6½	66
7 ,,	8⅛	49	8	56	7⅞	63	7¾	70	7¾	77
8 ,,	9⅝	56	9⅛	64	9	72	8⅞	80	8¼	88
9 ,,	10½	63	10¼	72	10⅛	81	10	90	9⅞	99
10 ,,	11⅝	70	11½	80	11¼	90	11⅛	100	11	110

LANTERN REFERENCE TABLE.

Distance between lens and screen.	Focus of Lens.											
	4 in.	5 in.	6 in.	7 in.	8 in.	9 in.	10 in.	11 in.	12 in.	13 in.	14 in.	
	Diameter of Disc.											
	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	
10 feet ..	7 6	6 0	5 0	4 3	3 9	3 4	3 0	2 9	2 6	2 4	2 2	
11 „ ..	8 3	6 7	5 6	4 9	4 2	3 8	3 4	3 0	2 9	2 6	2 4	
12 „ ..	9 0	7 2	6 0	5 2	4 6	4 0	3 7	3 3	3 0	2 9	2 7	
13 „ ..	9 9	7 10	6 6	5 7	4 11	4 4	3 11	3 7	3 3	3 0	2 9	
14 „ ..	10 6	8 5	7 0	6 0	5 3	4 8	4 2	3 10	3 7	3 3	3 0	
15 „ ..	11 3	9 0	7 6	6 5	5 8	5 0	4 6	4 1	3 9	3 6	3 3	
20 „ ..	15 0	12 0	10 0	8 7	7 6	6 8	6 0	5 6	5 0	4 7	4 3	
25 „ ..	18 9	15 0	12 6	10 9	9 4	8 4	7 6	6 10	6 3	5 9	5 4	
30 „ ..	22 6	18 0	15 0	12 10	11 3	10 0	9 0	8 2	7 6	6 11	6 5	
35 „ ..	26 3	21 0	17 6	17 0	13 1	11 8	10 6	9 6	8 9	8 1	7 6	
40 „ ..	30 0	24 0	20 0	17 2	15 0	13 4	12 0	10 10	10 0	9 2	8 6	
45 „ ..	33 9	27 0	22 6	19 3	16 10	15 0	13 6	12 3	11 3	10 4	9 8	
50 „ ..	37 6	30 0	25 0	21 5	18 9	16 8	15 0	13 8	12 6	11 6	10 9	

SHUTTER SPEEDS FOR MOVING OBJECTS.

From the "Wellcome Exposure Record and Diary."

The formula and table given below indicate the shutter speeds necessary to secure negatives sufficiently sharp for direct printing. For enlarging it is better to give $\frac{1}{2}$ to $\frac{1}{3}$ these exposures, or to work further from the object. *The figures are no guide to what is the correct exposure for the plate.*

If D = distance of object in feet, F = focal length of lens, S = speed of object in feet per second, and E = exposure for an object moving across the field of view, then

$$E = \frac{D}{100\ F \times S}$$

The following table gives in round figures the shutter speeds necessary for various moving objects, using the ordinary quarter-plate lens of about 5 in. focus. The column A is for objects moving directly towards the operator, B for objects moving obliquely towards or from the camera, that marked C for objects moving directly across the field of view.

Distance of Object, 25 ft., unless otherwise stated.	A.	B.	C.
Street groups (no rapid motion)	1/5	to	1/10
Pedestrians (two miles per hour) .. Animals grazing	1/20	1/40	1/60
Pedestrians (three miles per hour) ..	1/30	1/60	1/90
Pedestrians (four miles per hour)	1/40	1/80	1/120
Vehicles (six miles per hour)	1/60	1/120	1/180
Vehicles (eight miles per hour)	1/80	1/150	1/250
Cyclists and trotting horses	1/160	1/300	1/500
Foot races and sports	1/240	1/500	1/700
Divers	—	1/600	1/800
Cycle races, horse galloping	1/300	1/750	1/900
Yachts (10 knots per hour) at 50 ft. ..	1/60	1/120	1/180
Steamers (20 knots per hour) at 50 ft...	1/120	1/240	1/360
Trains (30 miles per hour) at 50 ft. ..	1/150	1/300	1/450
Trains (60 miles per hour) at 50 ft. ..	1/300	1/600	1/900

At 50 ft. the exposure may be double that at 25 ft.

At 100 ft. the exposure may be double that at 50 ft.

For lenses of greater or less focal length than 5 inches multiply above figures by 5 and divide by the focal length of the lens in inches. Thus for a 6-inch lens $\frac{1}{30} \times \frac{5}{6} = \frac{1}{36}$

AMIDOL DEVELOPER FOR BROMIDE PAPERS.

(Wellington Formula.)

Amidol	50 grains.
Sodium sulphite	650 „
Potassium bromide	10 „
Water	20 ounces.

This developer must be used within three days of mixing.

It is not advisable to put the prints into water after developing and before fixing them, as the developer goes on acting to a slight extent, and prints so treated will be found to be less brilliant and have a greyish veil in the whitest parts which should not be present.

ACID FIXING BATH FOR BROMIDE PAPERS.

Hypo	4 ounces.
Potassium metabisulphite	200 grains.
Water	1 pint.

Immerse prints face downwards and don't allow them to float on top of the bath, or discoloration is likely to occur.

TO CLEAR UP HIGH-LIGHTS OR REMOVE PRESSURE MARKS FROM THICK BROMIDE PAPERS.

For this purpose we like the Wellington formula :—

Potassium iodide	30 grains.
Water	10 ounces.
Iodine	3 grains.

Place the print in this solution for a few minutes till the objectionable marks disappear, disregarding the blue tint of the high-lights. Then transfer to clean hypo, wash and dry.

TONING BROMIDE PRINTS.

Make two Stock Solutions as follows :—

No. 1.	Potassium ferricyanide	400 grains.
	Potassium bromide	600 „
	Water	10 ounces.
No. 2.	Sodium sulphide, pure	1 oz.
	Water	10 ounces.

Take of No. 1 Solution 1 ounce to water 10 ounces and immerse the print till it is bleached, then rinse in water and immerse in

No. 2.	Solution	½ ounce.
	Water	10 ounces.

In this the print gradually changes to a fine sepia colour. When the action is complete well wash in several changes of water.

Printed by Percy Lund, Humphries & Co., Ltd., Bradford and London. 14468

Are you ready for the UNA?

The key to your progress is your camera. Does it limit you—hold you back from that better work you wish, always, to do? The limitations of your outfit build a wall about your progress as a practical photgrapher? Now, for such photographers as desire the ideal outfit—a really practical hand-and-stand camera which will do everything—we have designed and fashioned what we claim to be the finest universal camera in the world, the Sinclair UNA. Are you ready for it?

Here, then, are details.

The Sinclair UNA is the result of years-long thought and planning. Briefly, the UNA has been made for practical workers who want the best possible.

Every movement and convenience essential for photography of the widest character has been included in the UNA. Everything not essential has been eliminated. We have studied the hand camera, and the stand cameras of the world—analysing their advantages and their imperfections; and we have combined in the UNA the practical advantages of all, with some features that are missing from most cameras. We now affirm that we have made a camera which cannot be equalled in all the world for all-round, practical, efficient usefulness and reliability: the Sinclair UNA hand-and-stand "Universal" Camera.

The Sinclair UNA will give you power to do every class of work. It is a perfect hand camera and is also the equal, instantly, of the weighty stand outfits, for it is a stand camera too. Its weight is less than that of many hand cameras pure and simple! It will take long, short or medium focus lenses. It may be fitted with *any* shutter. All its movements are simple, yet intensely useful and efficient for every subject. It has a very great rising front—a central swing front. It has a perfected revolving back for changing position of plate or film instantly. For snapshot work, landscapes, architecture, portraiture, copying—everything, it is ideal and absolutely simple to use.

No camera of the day is so perfectly made and none is so strongly made. It is a camera for a lifetime of high-quality work—essentially an instrument for the practical man who would have "everything" in one neat, beautifully-made instrument. Prices, with lens and slides complete, from £7 17s. 6d.

We invite you to write to us for full illustrated details and price list. A special pamphlet will be sent, free of charge.

James A. Sinclair & Co., Ltd.
54, Haymarket, London, S.W.

Why a Reflex?

Well then, here are some of the reasons. With a reflex camera you have visible and certain focussing up to the very instant of exposure. Even as the joy of reading is mostly in the recognition of what we know, so the fascination of reflex work dwells in the recognition, within the magic hood, of the picture that you want to perpetuate. Full size you see your picture, as you want it, when you want it! Just like a kinemacolor within the hood. With a reflex you cannot mis-focus; nor can you mis-fire.

And Why the "N.S." Reflex.

The "N. S." Reflex Camera represents a brain-combine: it is a "NEWMAN-SINCLAIR." Those experienced in camera construction will know how much this means; for the uninitiated we can only say that it stands for all that is finest and most modern in British hand-camera invention and construction.

The "N.S." Reflex was the first reflex to do away with the "rubber blinds" trouble—the "N.S." is not a focal-plane instrument—it has a diaphragm shutter, giving speeds of ½ to 1/100th second, as well as time exposures.

The "N.S." represents a bold departure from the standard types which are built for cheapness; it is a camera for a lifetime. Why do you never see an "N.S." in the "second-hand" lists? No one ever parts with an "N.S."!

Many reflex cameras are ugly and cumbrous, but the "N.S." is dainty enough for a lady's hands, and exquisitely fashioned and manufactured; yet, considering the luxuries and pleasures it adds to photographic work, the beauty of its details, and the strength and reliability of its parts, it is not expensive.

The "N.S." Reflex allows of exact focussing even with a large-aperture lens; even with a long-focus lens; even when very near the object photographed—because it is a reflex. Even when the rising front is used you can arrange your subject on the ground glass, certain that the negative will be an exact reproduction of the picture you then see.

The lens regularly supplied with the "N.S." Reflex is the Zeiss Tessar Anastigmat, working at the wide aperture of F/4·5. Think of the work you can do with such a lens, with such a camera! The definition afforded by the lens of the "N.S." is such that the picture you see within the hood of the "N.S." is even more full of detail than the object you are photographing as seen by your own eyes! Your eye is a good lens, but the Zeiss Tessar is a better one. You can prove this by comparing your vision with that shown on the ground glass of the "N.S." as you take your photograph. An F/4·5 lens confers a boon on any photographer, but you need a camera like the "N.S." to reap the full benefits of such an aperture. The "N.S." Reflex enables you to localise the focus of this splendid aperture on one spot with absolute certainty and with the utmost ease.

The "British Journal Photographic Almanac" said of the "N.S" Reflex: "**This is the most notable departure in hand camera construction during the past ten years.**"

Send for the "N.S." Illustrated Booklet.

¼-plate, complete with Zeiss Tessar Lens - - £23 10 0

9×12 c/m - £28 10 0 5×4 - £30 0 0

JAMES A. SINCLAIR & Co., Ltd.,

54, HAYMARKET, LONDON, S.W.

Contractors to H.M. Government.